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Sanchit Socket

1. Introduction to Java

1. Why you must learn Java
2. What is a Programming Language
3. What is an Algorithm
4. What is Syntax
5. History of Java
6. Magic of Byte Code
7. How Java Changed the Internet
8. Java Buzzwords
9. Object Oriented Programming

1.1 Why you must learn Java

1. One of the most popular language. Java currently runs on 60,00,00,00,000 devices.
2. Wide Usage (Web-apps, backend, Mobile apps, enterprise software).
3. High paying and a lot of Jobs
4. Object Oriented
5. Rich APIs and Community Support

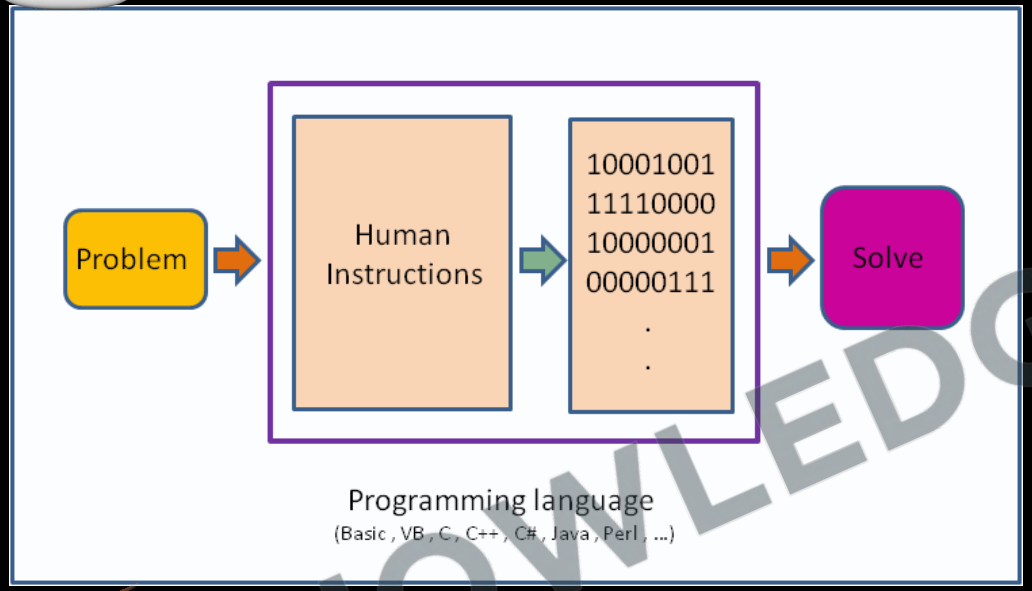
1.2 What is a Programming Language

Humans use natural language (like Hindi/English) to communicate

1.2 What is a Programming Language

Computers only understand 0/1 or on/off

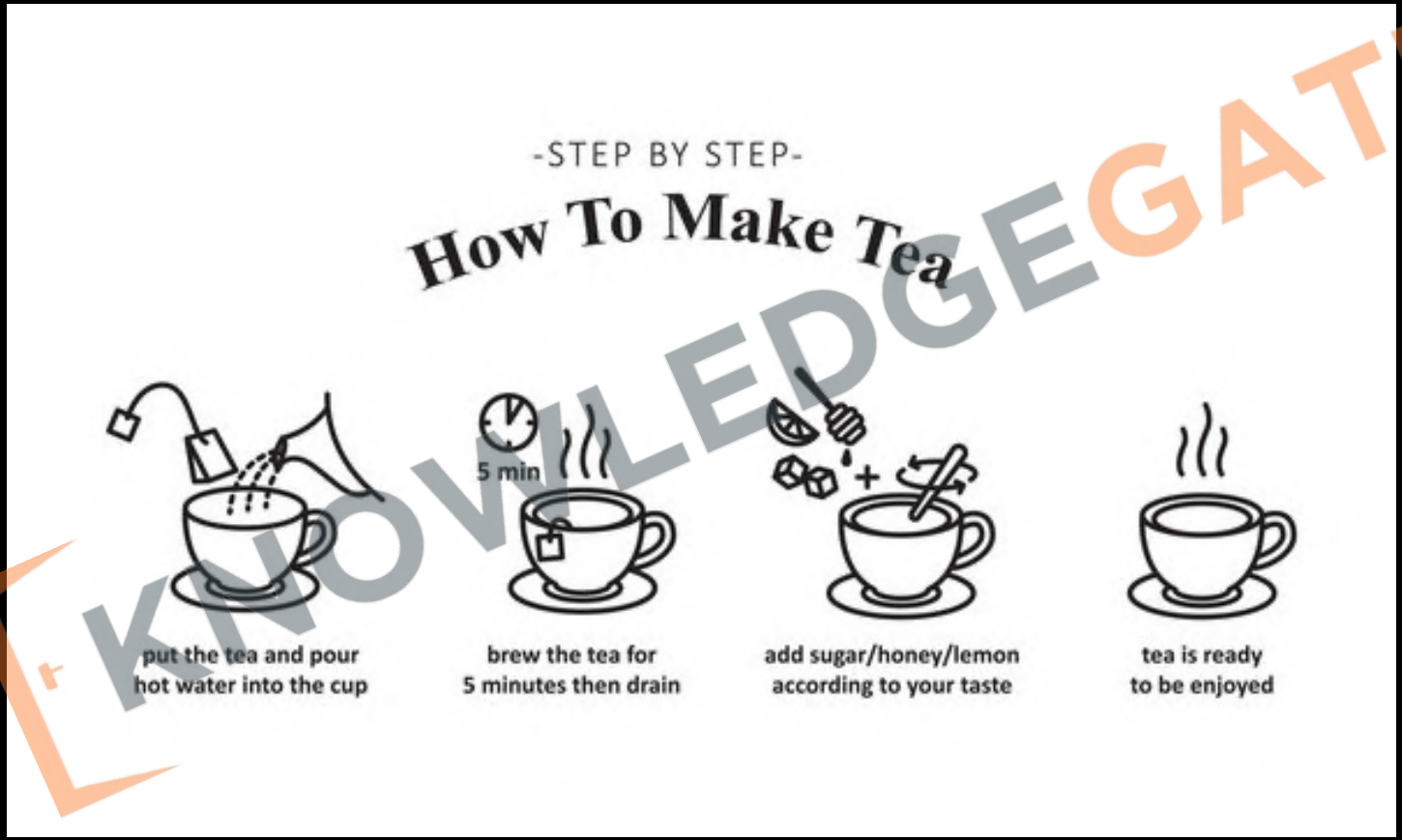
1.2 What is a Programming Language



- Giving instructions to a computer
- **Instructions**: Tells computer what to do.
- These instructions are called code.
- Human instructions are given in High level languages.

Compiler converts high level languages to low level languages or machine code.

1.3 What is an Algorithm



1.3 What is an Algorithm

An algorithm is a step-by-step procedure for solving a problem or performing a task.

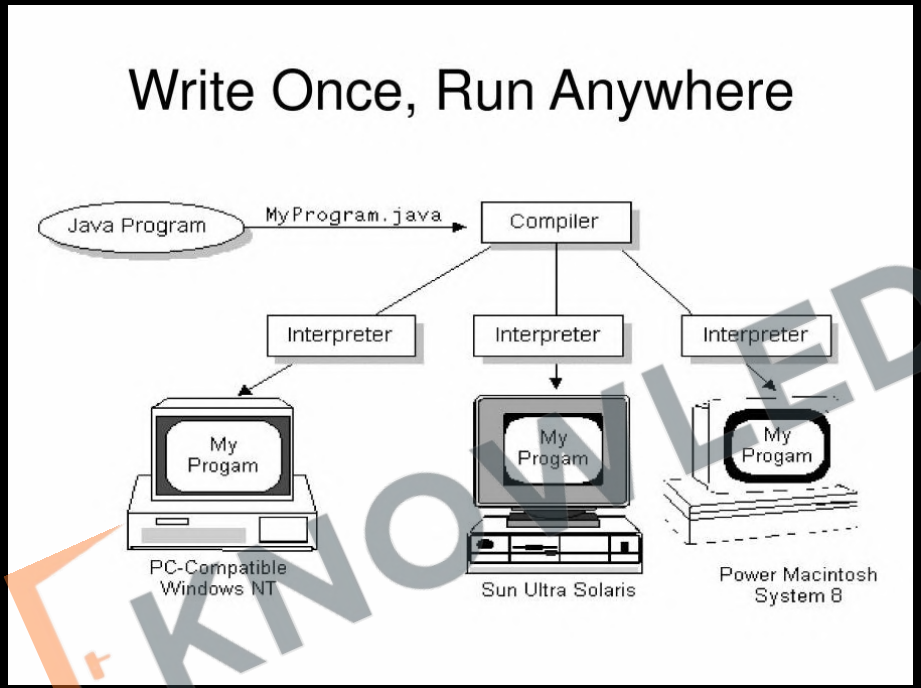
1.4 What is Syntax

- Structure of words in a sentence.
- Rules of the language.
- For programming exact syntax must be followed.

1.5 History of Java

Developed by James Gosling at Sun Microsystems (Early 1990s):
Originally named 'Oak', later renamed Java in 1995.

1.5 History of Java

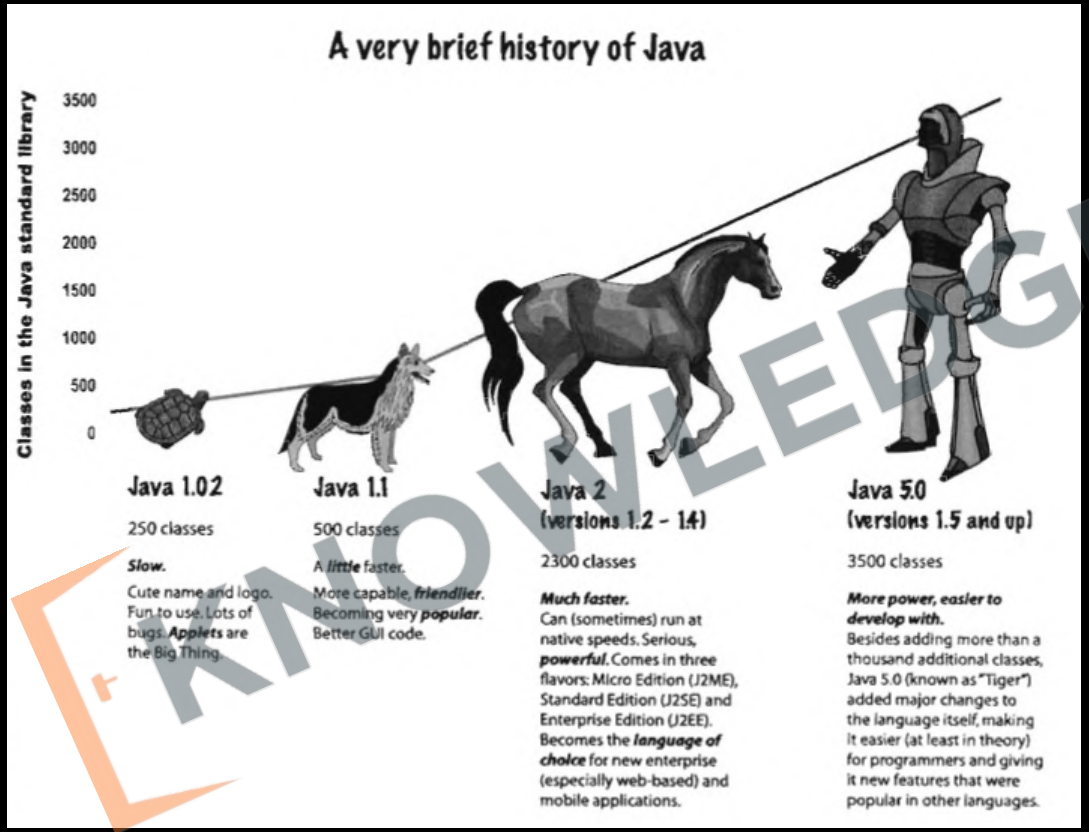


First Release (1995): Introduced "Write Once, Run Anywhere" concept with cross-platform compatibility.

1.5 History of Java

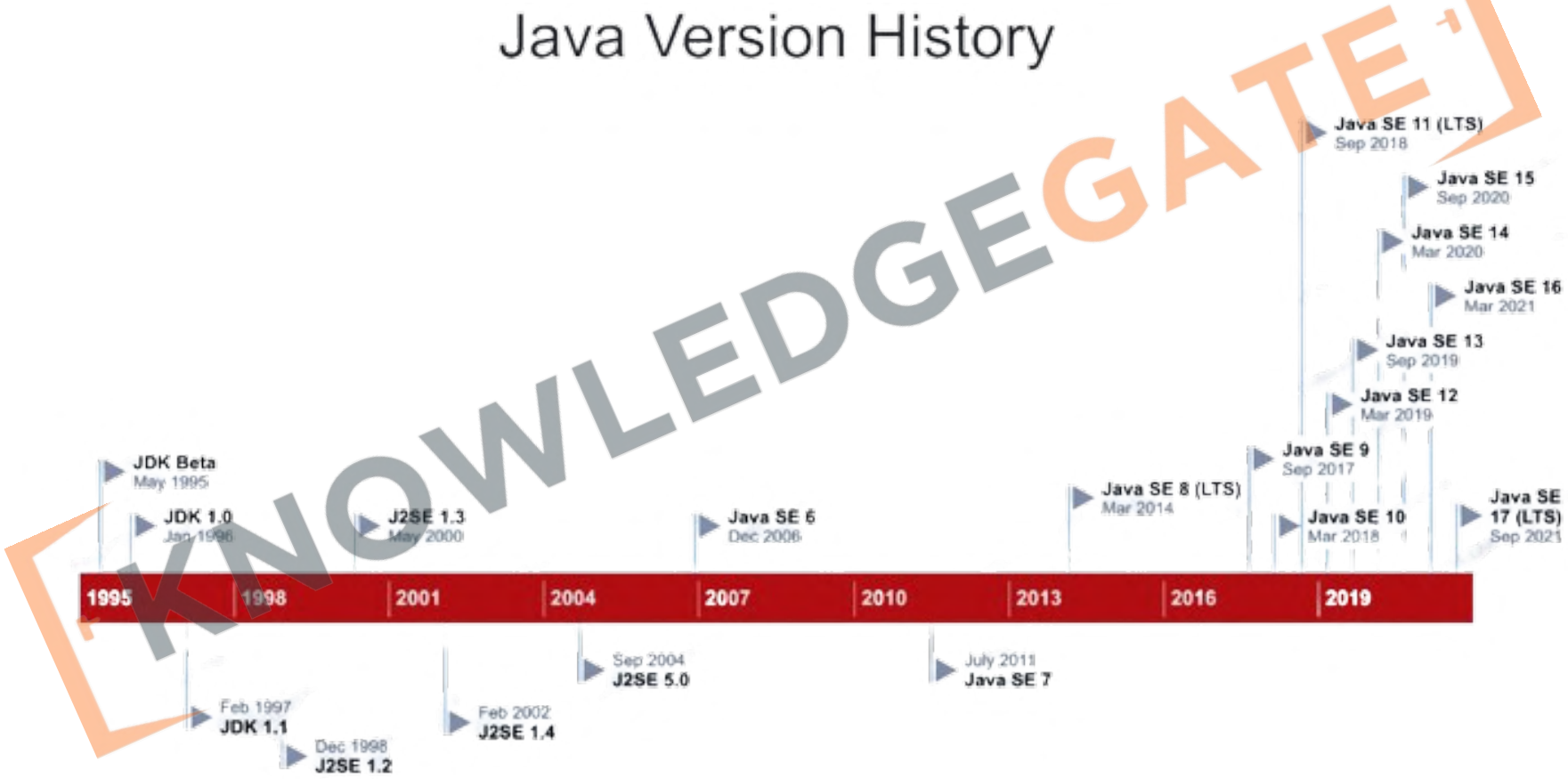
Developed with vision of backward compatibility. Should not break with new version release.

1.5 History of Java

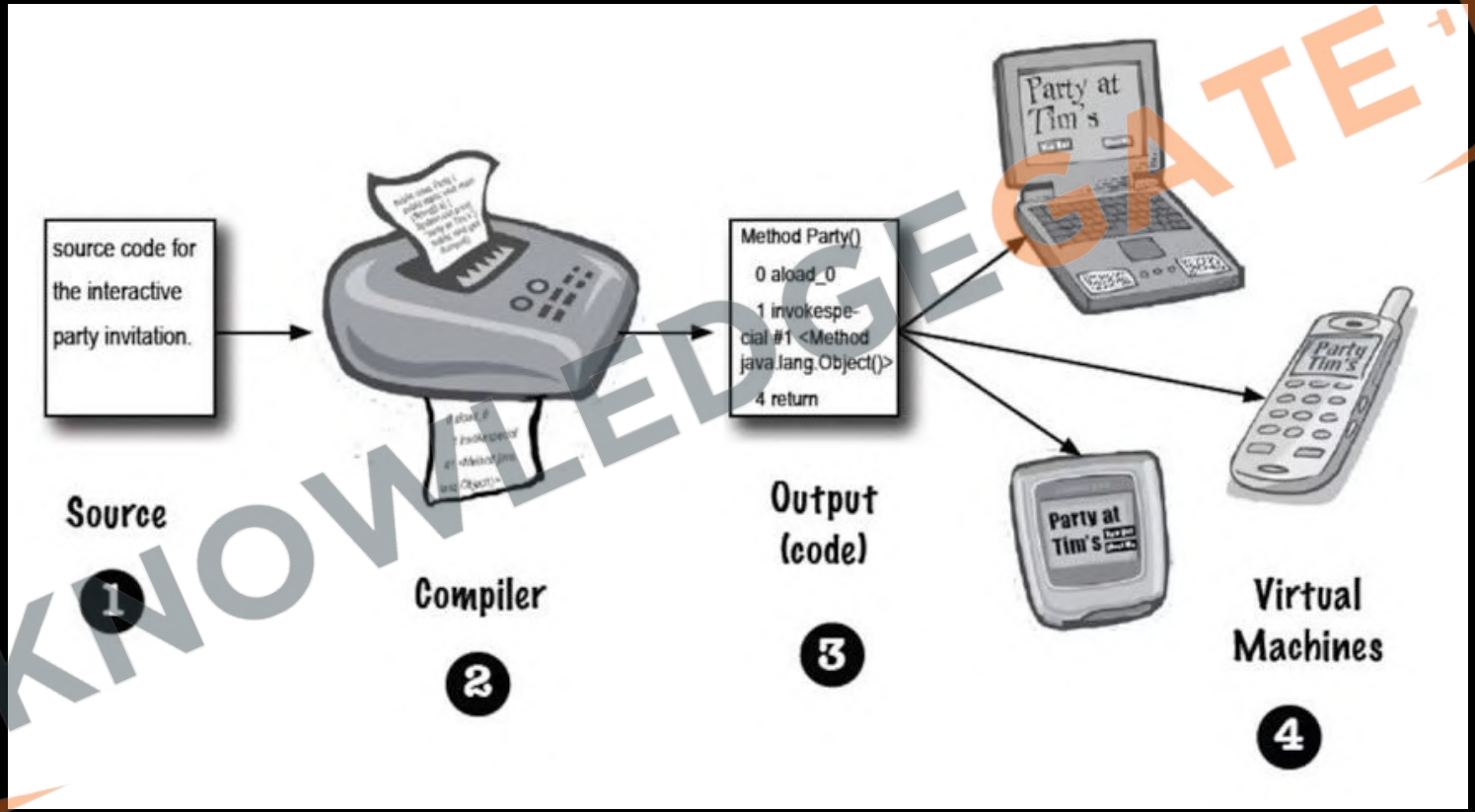


Rapid Growth and Diversification (Late 1990s - 2010s): Expanded from web applets to server-side applications; standardized into different editions for various computing platforms.

1.5 History of Java



1.6 Magic of Byte Code



1.7 How Java Changed the Internet

Portability with Write Once Run Anywhere

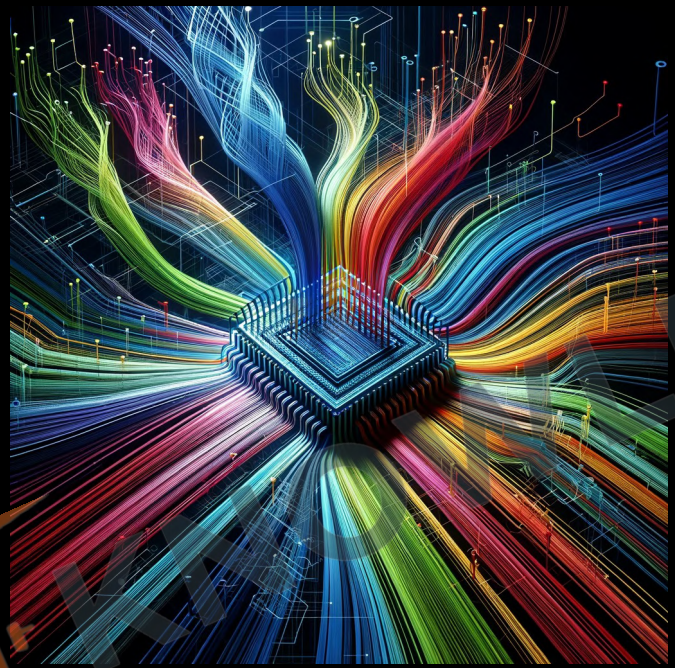
Security because of Code running on Virtual Machine

1.8 Java Buzzwords

Robust

Java is robust due to its strong memory management, exception handling, and type-checking mechanisms, which help in preventing system crashes and ensuring reliable performance.

1.8 Java Buzzwords



Multithreaded

Multithreading in programming is the ability of a CPU to execute multiple threads concurrently, allowing for more efficient processing and task management.

1.8 Java Buzzwords

Architecture Neutral

Java is architecturally neutral because its compiled code (bytecode) can run on any device with a Java Virtual Machine (JVM), regardless of the underlying hardware architecture.

1.8 Java Buzzwords

Interpreted and High Performance

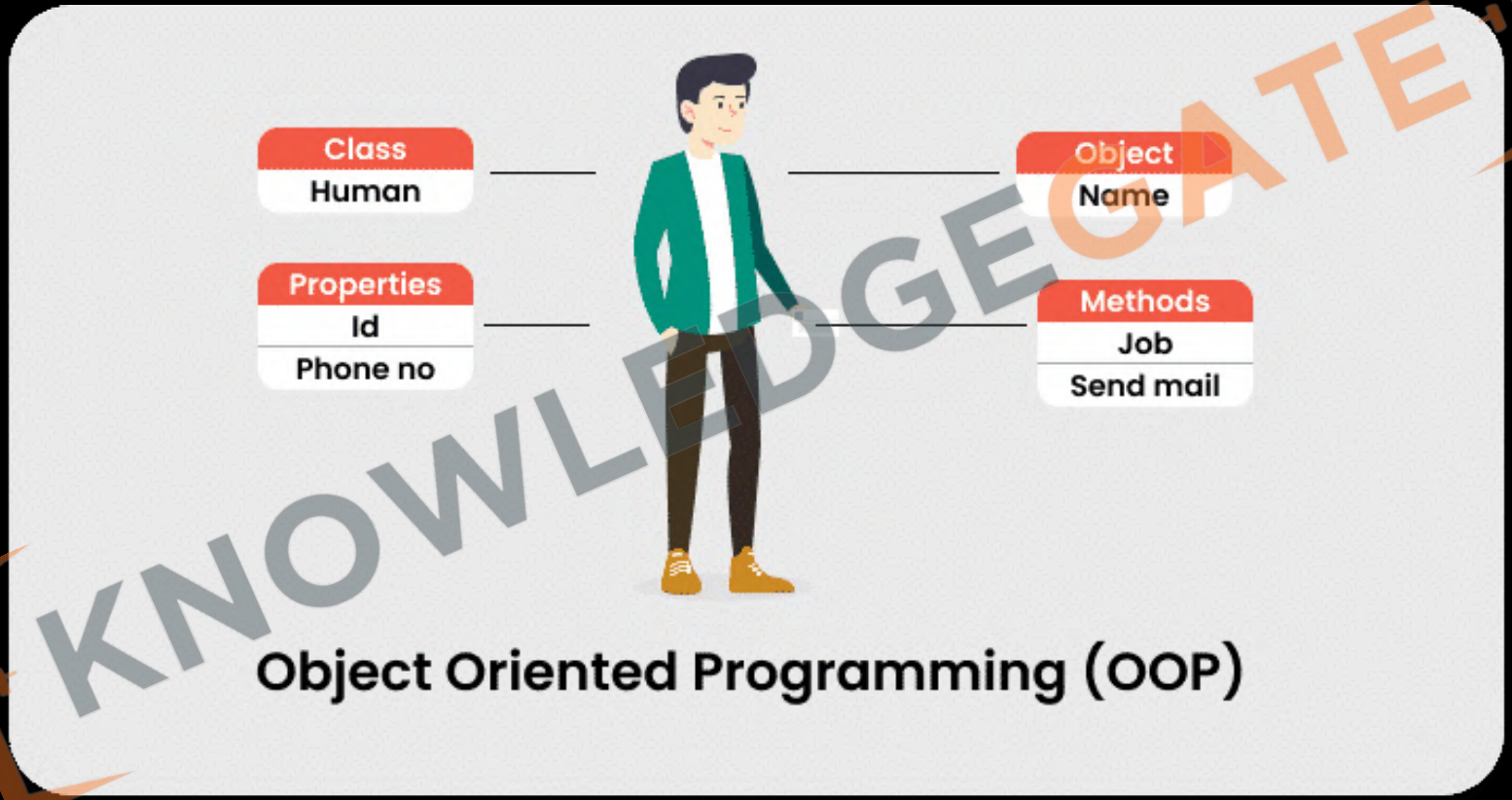
Java combines high performance with interpretability, as its bytecode is interpreted by the Java Virtual Machine (JVM), which employs Just-In-Time (JIT) compilation for efficient and fast execution.

1.8 Java Buzzwords

Distributed

Java is inherently distributed, designed to facilitate network-based application development and interaction, seamlessly integrating with Internet protocols and remote method invocation.

1.9 Object Oriented Programming



1.9 Object Oriented Programming

Revision

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2. Java Basics

1. Installing JDK
2. First Class using Text Editor
3. Compiling and Running
4. Anatomy of a Class
5. File Extensions
6. JDK vs JVM vs JRE
7. Showing Output
8. Importance of the main method
9. Installing IDE(Intellij Idea)
10. Creating first Project

2.1 Installing JDK

- Search JDK Download
- Make sure to download from the oracle website.
- Download the latest version

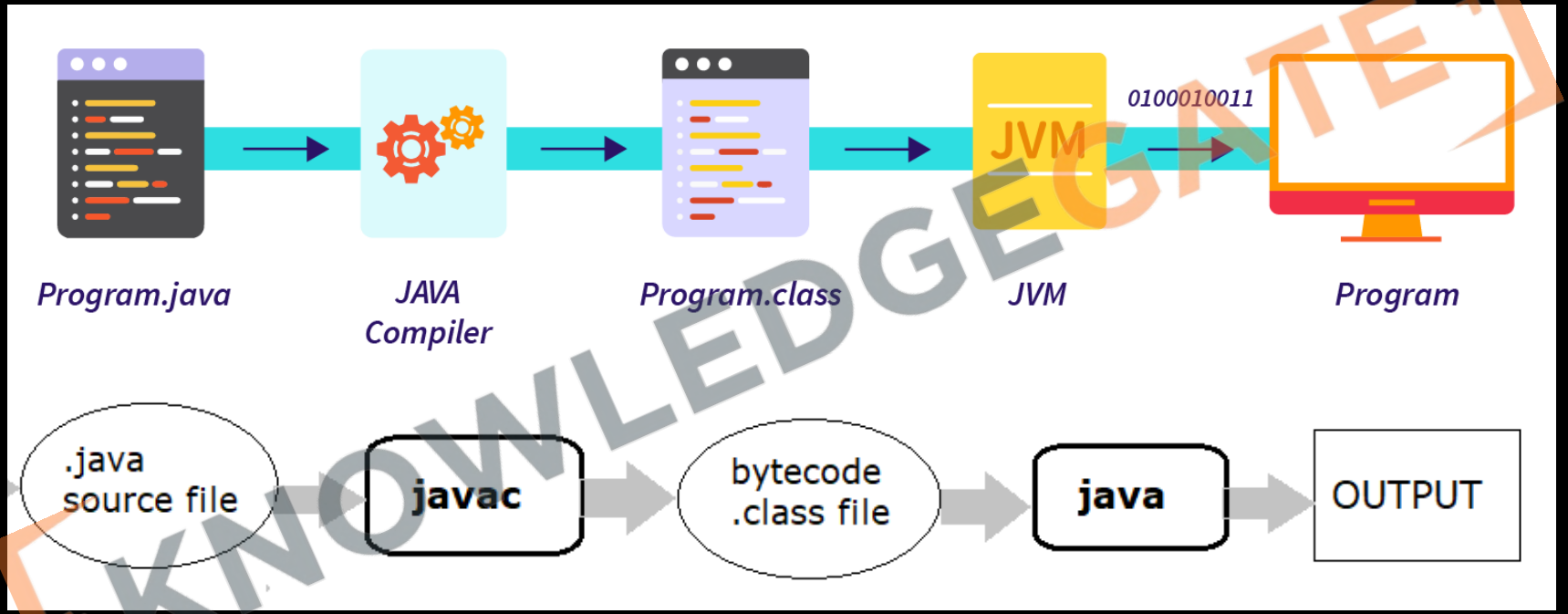
2.2 First Class using Text Editor

First.java

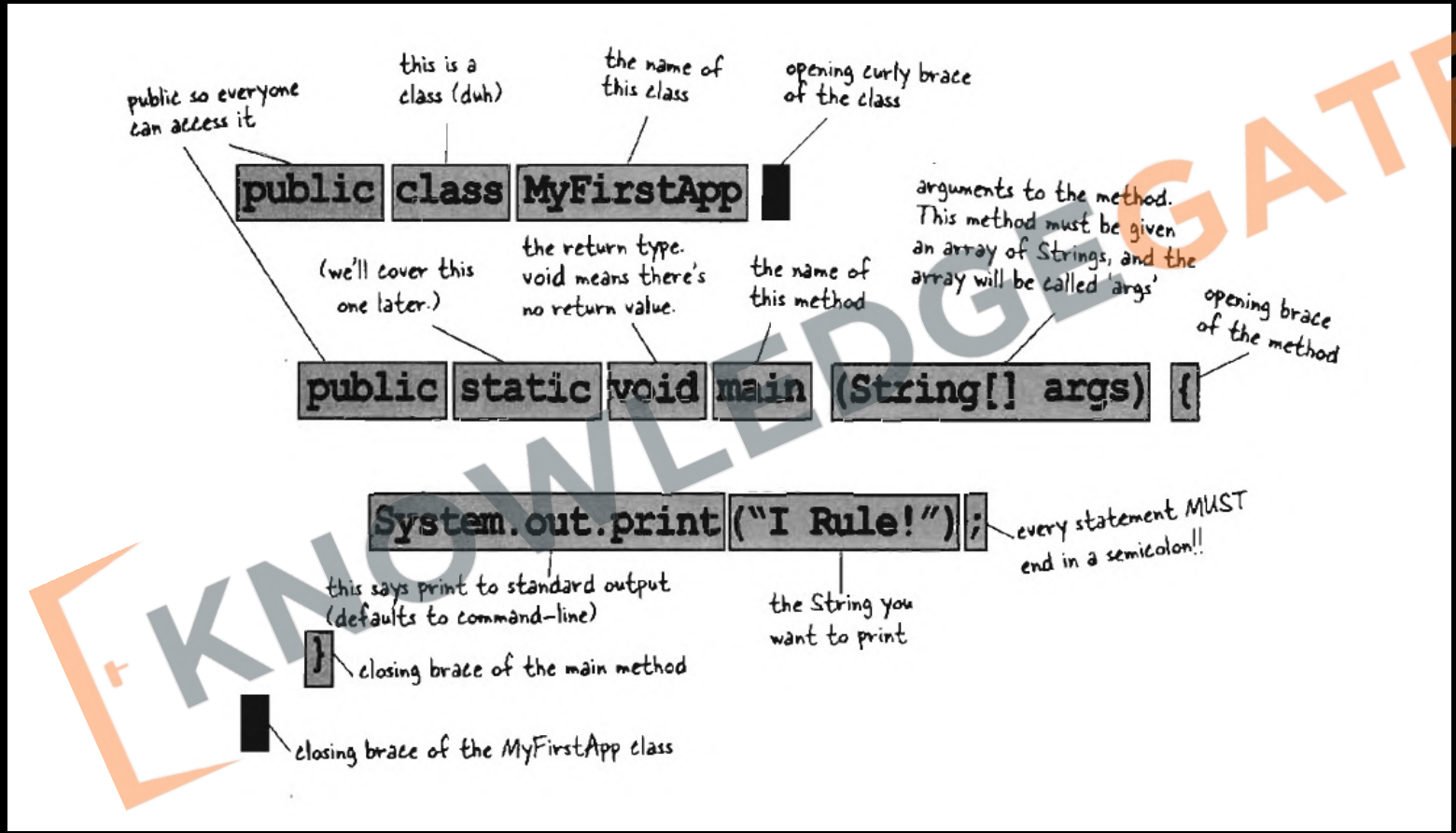
```
import java.lang.*;

public class First {
  public static void main(String[] args) {
    System.out.println("Welcome to KGCoding");
  }
}
```

2.3 Compiling and Running



2.4 Anatomy of a Class



2.5 File Extensions

.Java

- Contains Java Source Code
- High Level Human Readable
- Used for Development
- File is editable

.Class

- Contains Java Bytecode
- For consumption of JVM
- Used for Execution
- Not meant to be edited

Main.java

```java
public class Main {
    public static void main(String[] args) {
        System.out.println("Hello world!");
    }
}
```

Main.class

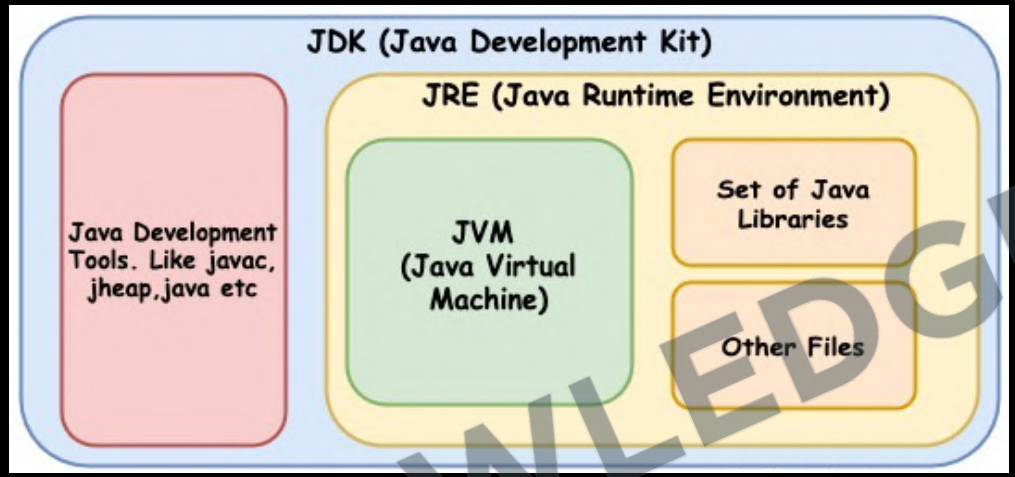
```
java/lang/Object<init>()V

java/lang/SystemoutLjava/io/PrintStream;
Hello world!

java/io/PrintStreamprintln(Ljava/lang/
String;)VMainCodeLineNumberTableLocalVariableTablethisLMain;ma
in([Ljava/lang/String;)Vargs[Ljava/lang/String;
SourceFile      Main.java!/*∑±
        7       ≤
∂

        !
```

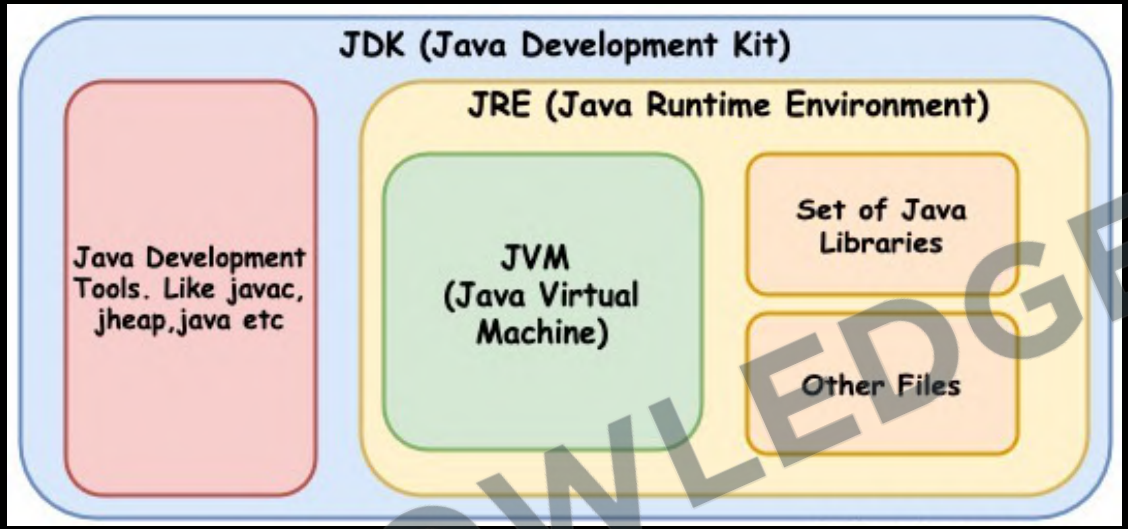
2.6 JDK vs JVM vs JRE



.JDK

- It's a software development kit required to develop Java applications.
- Includes the JRE, an interpreter/loader (Java), a compiler (javac), a doc generator (Javadoc), and other tools needed for Java development.
- Essentially, JDK is a superset of JRE.

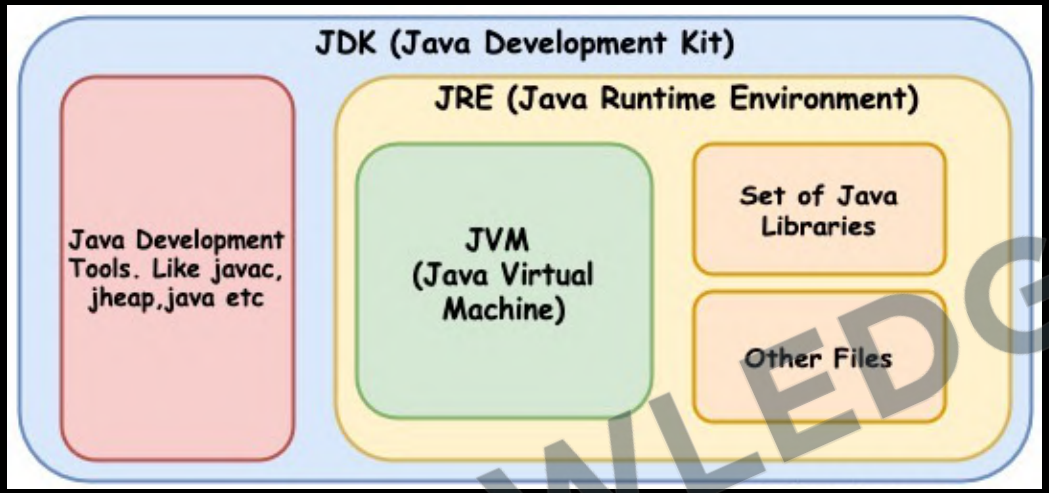
2.6 JDK vs JVM vs JRE



.JRE

- It's a part of the JDK but can be downloaded separately.
- Provides the libraries, the JVM, and other components to run applications
- Does not have tools and utilities for developers like compilers or debuggers.

2.6 JDK vs JVM vs JRE



.JVM

- It's a part of JRE and responsible for executing the bytecode.
- Ensures Java's write-once-run-anywhere capability.
- Not platform-independent: a different JVM is needed for each type of OS.

2.7 Showing Output

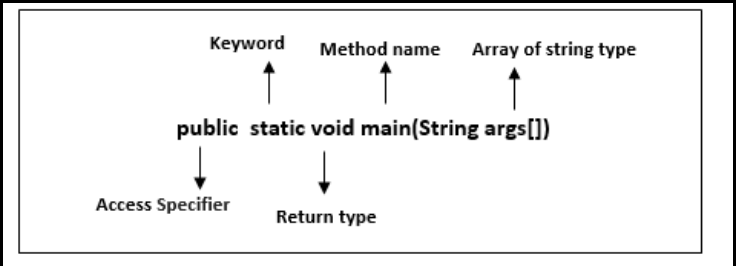
Example	Result

`System.out.print("one");`
`System.out.print("two");`
`System.out.println("three");`
	onetwothree

`System.out.println("one");`
`System.out.println("two");`
`System.out.println("three");`
	one
	two
	three

`System.out.println();`	[new line]

2.8 Importance of the main method



- Entry Point: It's the entry point of a Java program, where the execution starts. Without the main method, the Java Virtual Machine (JVM) does not know where to begin running the code.
- Public and Static: The main method must be public and static, ensuring it's accessible to the JVM without needing to instantiate the class.
- Fixed Signature: The main method has a fixed signature: public static void main(String[] args). Deviating from this signature means the JVM won't recognize it as the starting point.

2.9 What is IDE

1. IDE stands for Integrated Development Environment.
2. Software suite that consolidates basic tools required for software development.
3. Central hub for coding, finding problems, and testing.
4. Designed to improve developer efficiency.

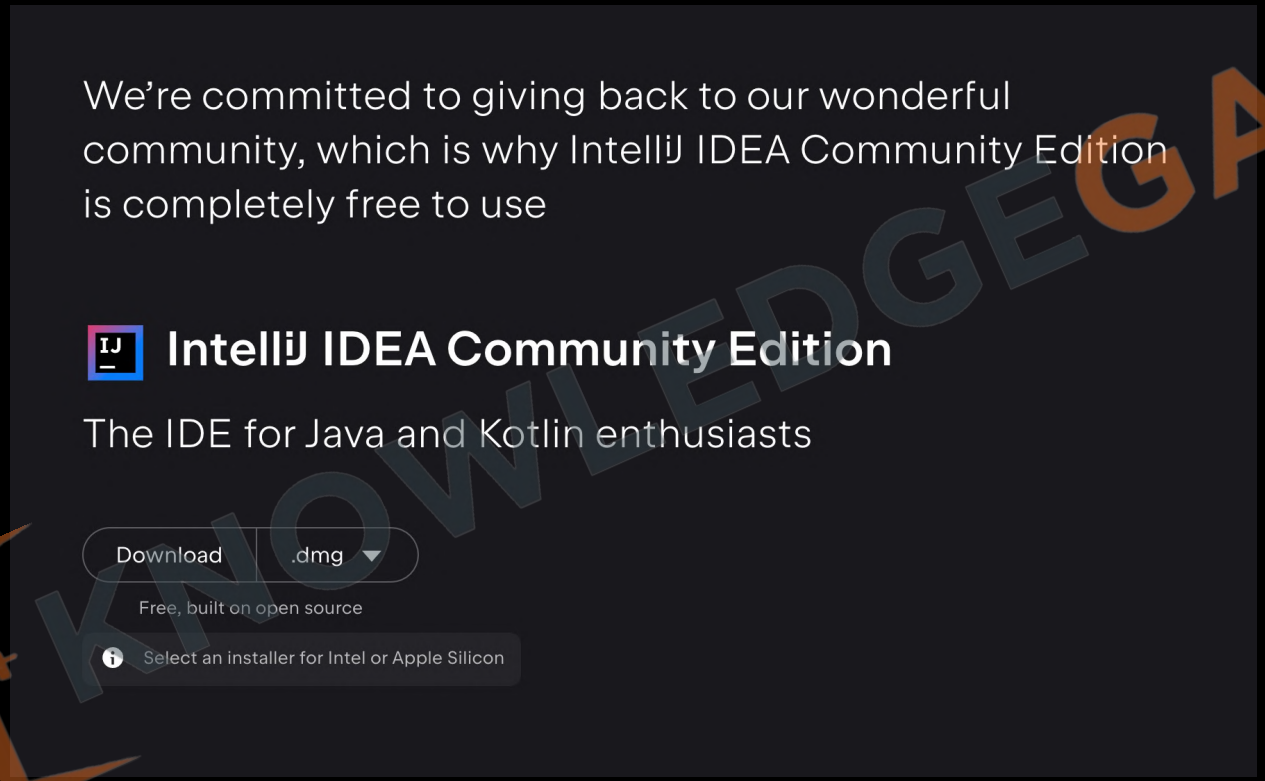
2.9 Need of IDE

1. Streamlines development.
2. Increases productivity.
3. Simplifies complex tasks.
4. Offers a unified workspace.
5. IDE Features
    1. Code Autocomplete
    2. Syntax Highlighting
    3. Version Control
    4. Error Checking

2.9 Installing IDE(Intellij Idea)

- Search Intellij IDEA
- Make sure to download the community Version.
- Keep Your Software up to date.

2.9 Installing IDE(Intellij Idea)



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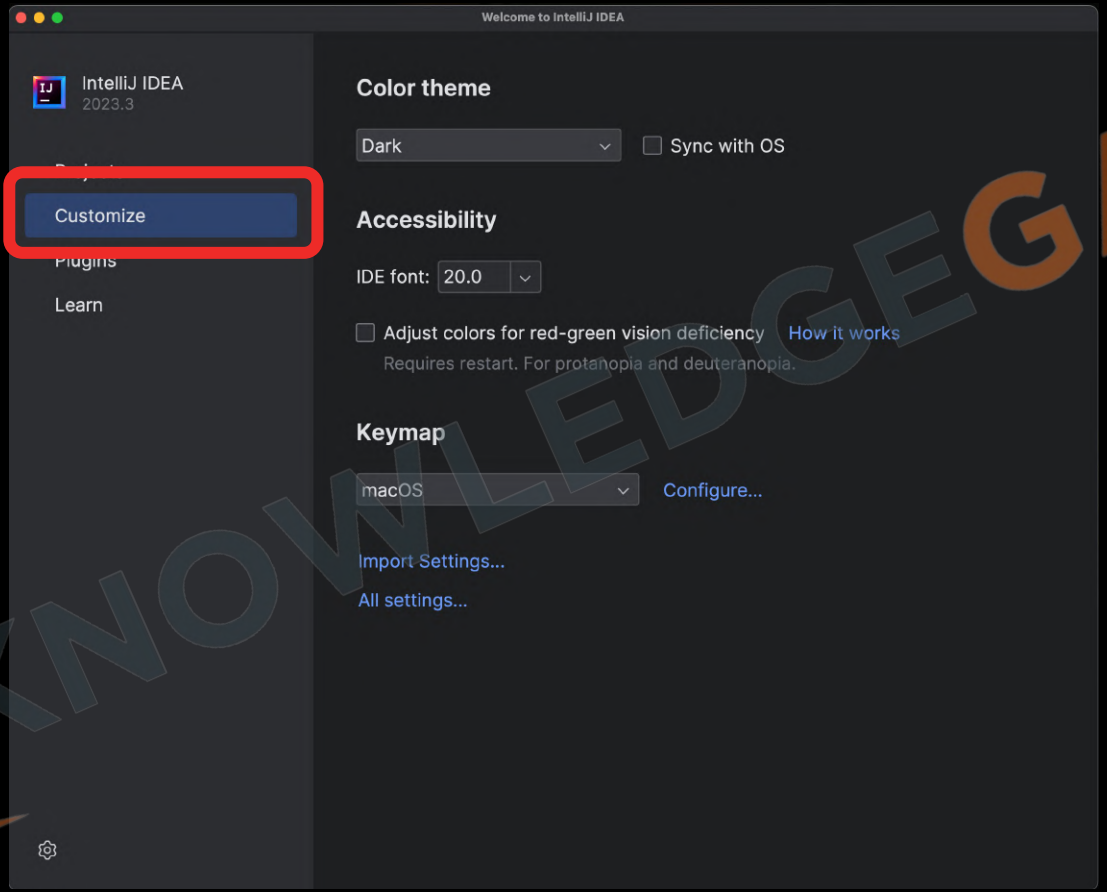

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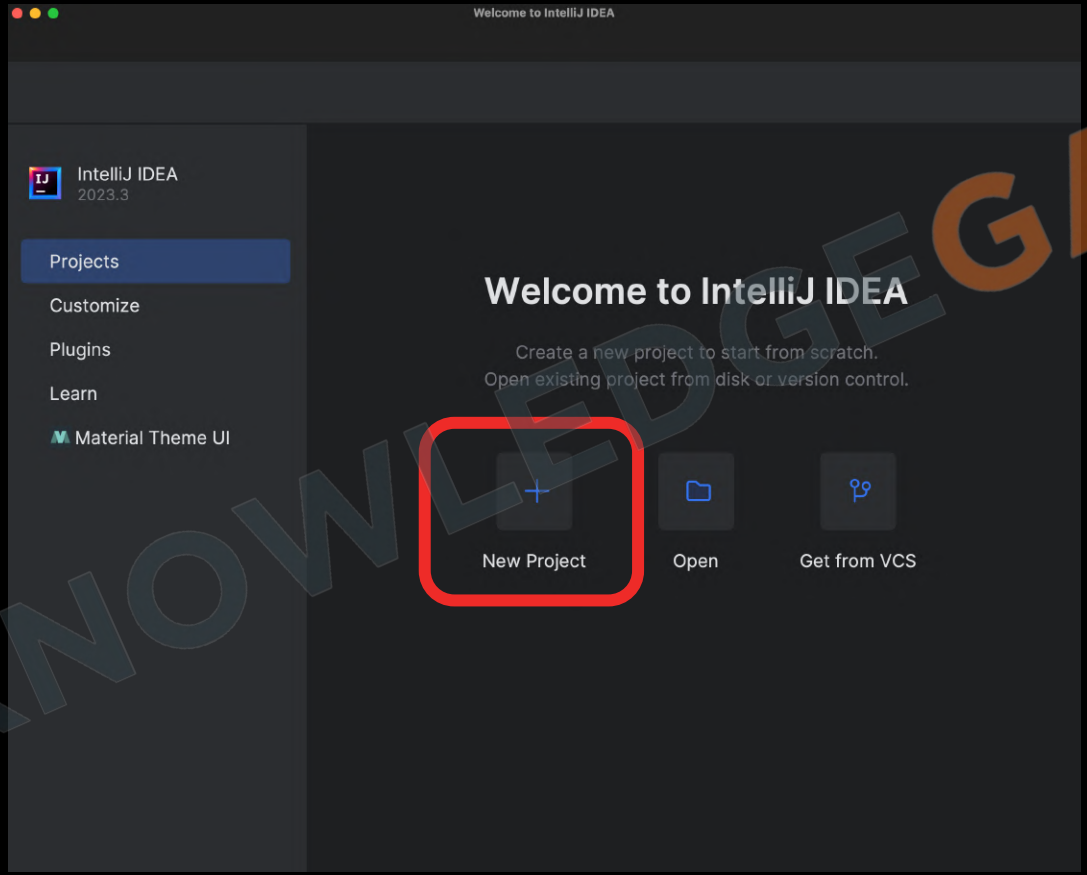

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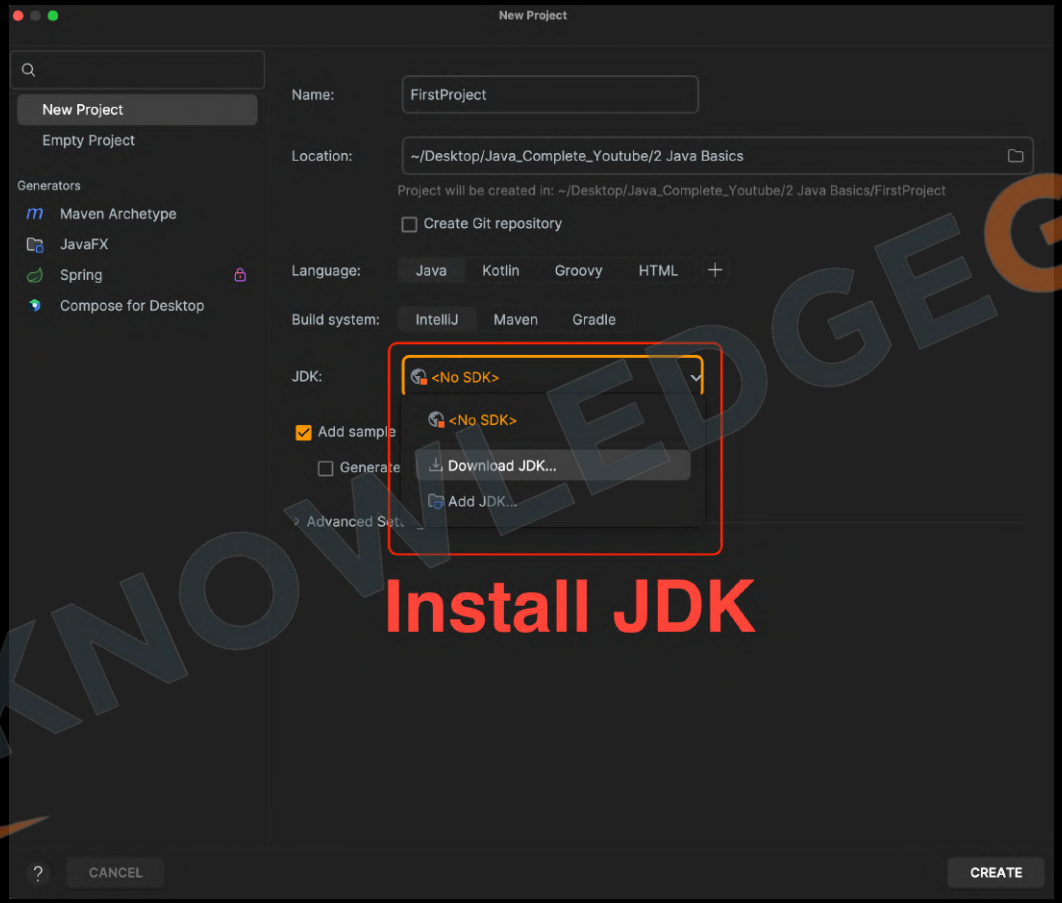
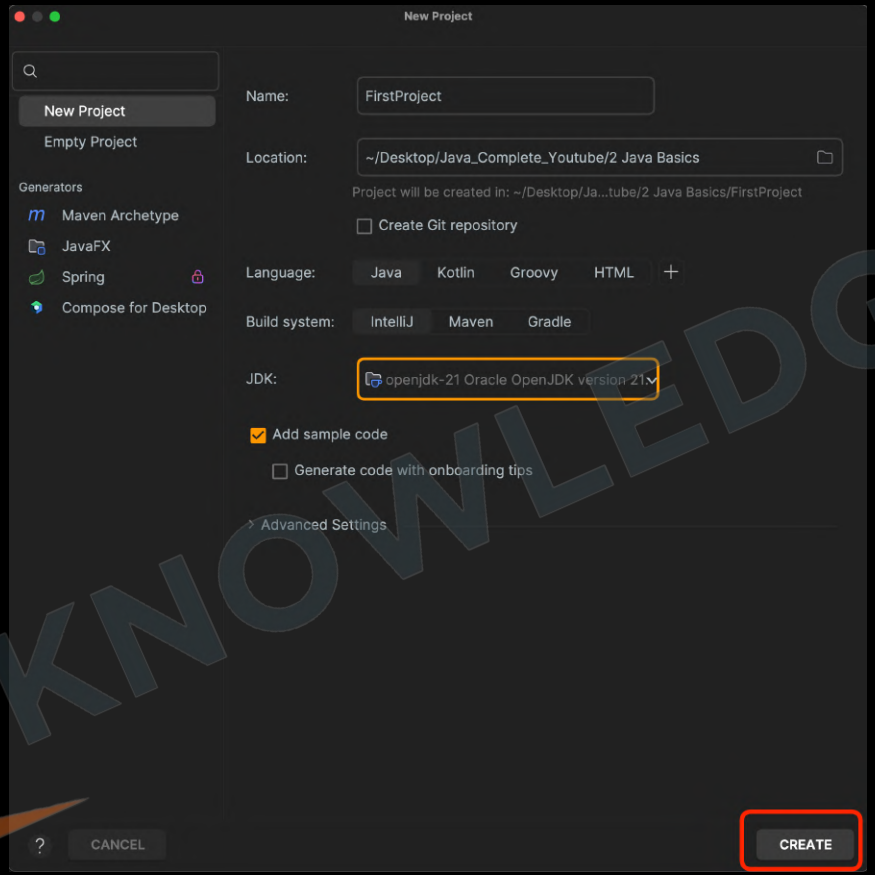


Install JDK

2.10 Creating first Project

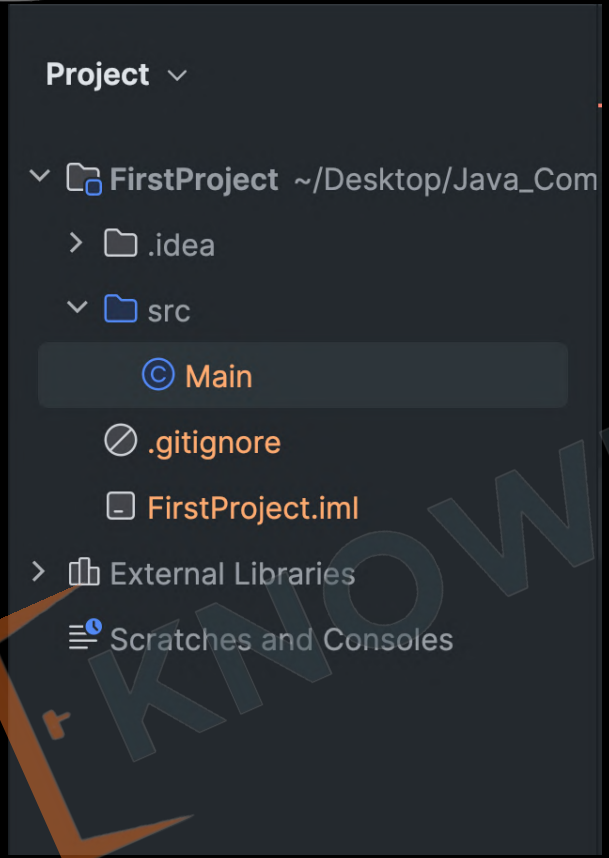


2.10 First Java Class

Main.java

```java
public class Main {
    public static void main(String[] args) {
        System.out.println("Hello world!");
    }
}
```

2.10 Project Structure



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4. Anatomy of a Class
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7. Showing Output
8. Importance of the main method
9. Installing IDE(Intellij Idea)
10. Creating first Project

CHALLENGE

Tasks:

1. Create a class to output “good morning” using a text editor and check output.
2. Create a new Project in Intelij Idea and output “subscribe” on the console.
3. Show the following patterns:

Practice Exercise

Java Basics

Answer in True/False:

1. Computers understand high level languages like Java, C.
2. An Algorithm is a set of instructions to accomplish a task.
3. Computer is smart enough to ignore incorrect syntax.
4. Java was first released in 1992.
5. Java was named over a person who made good coffee.
6. ByteCode is platform independent.
7. JDK is a part of JRE.
8. It's optional to declare main method as public.
9. .class file contains machine code.
10. println adds a new line at the end of the line.

Practice Exercise

Java Basics

Answer in True/False:

1. Computers understand high level languages like Java, C. — False
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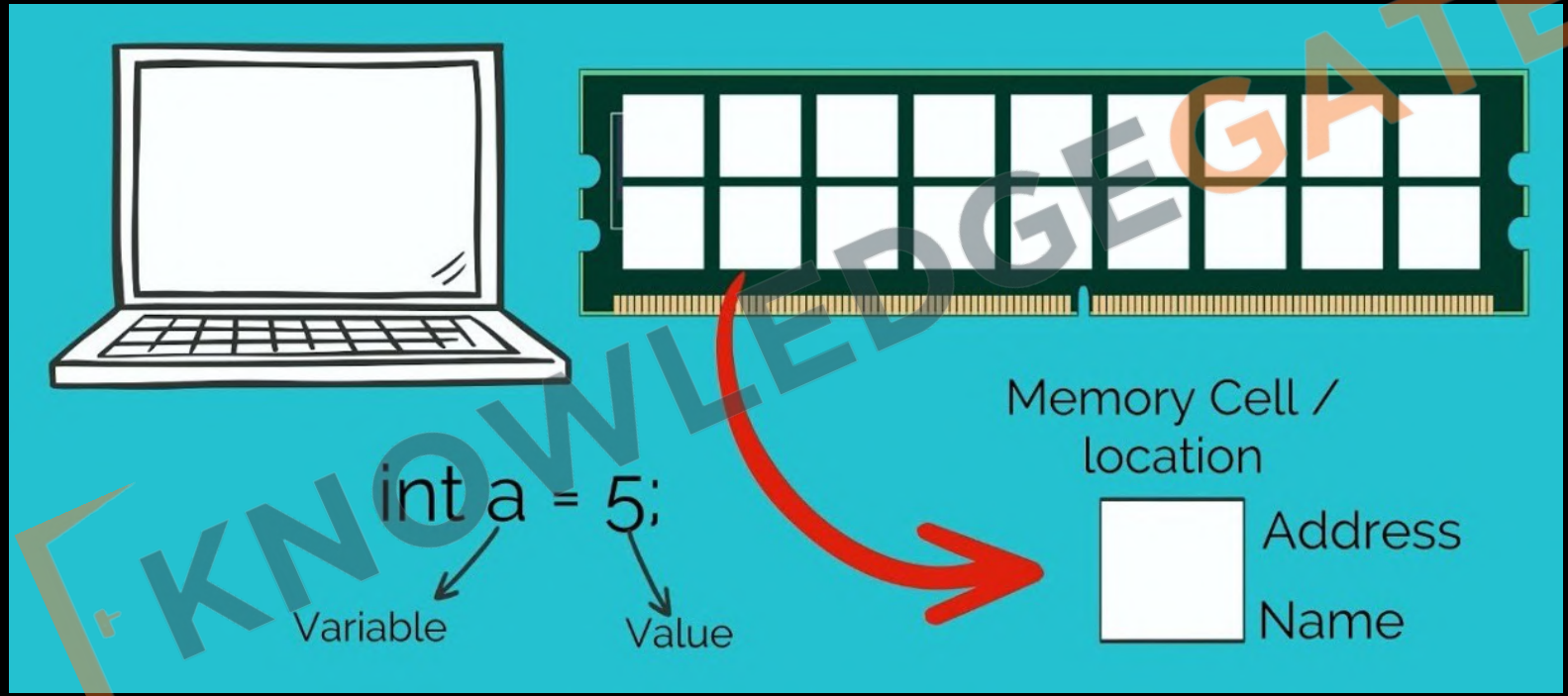
3 Data Types, Variables & Input

1. Variables
2. Data Types
3. Naming Conventions
4. Literals
5. Keywords
6. Escape Sequences
7. User Input
8. Type Conversion and Casting

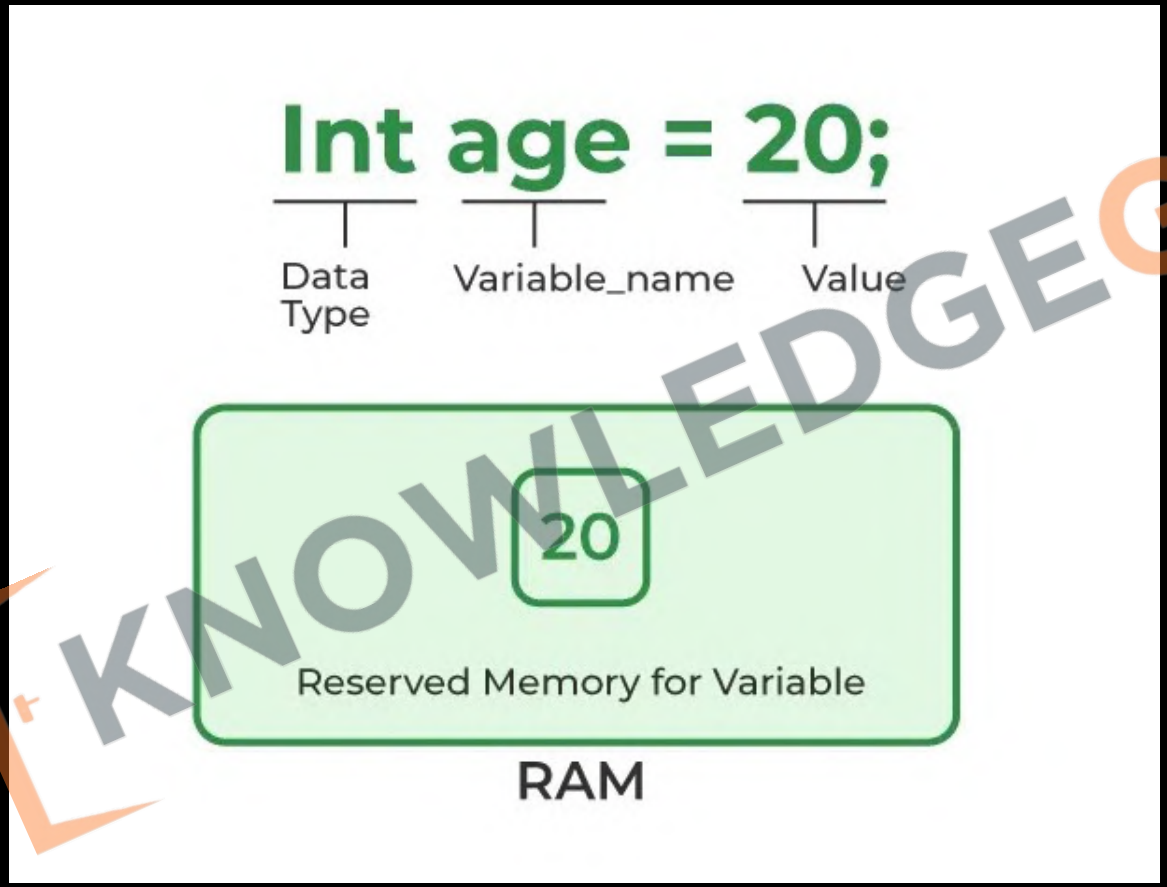
3.1. What are Variables?

Variables are like containers used for storing data values.

3.1. Memory Allocation



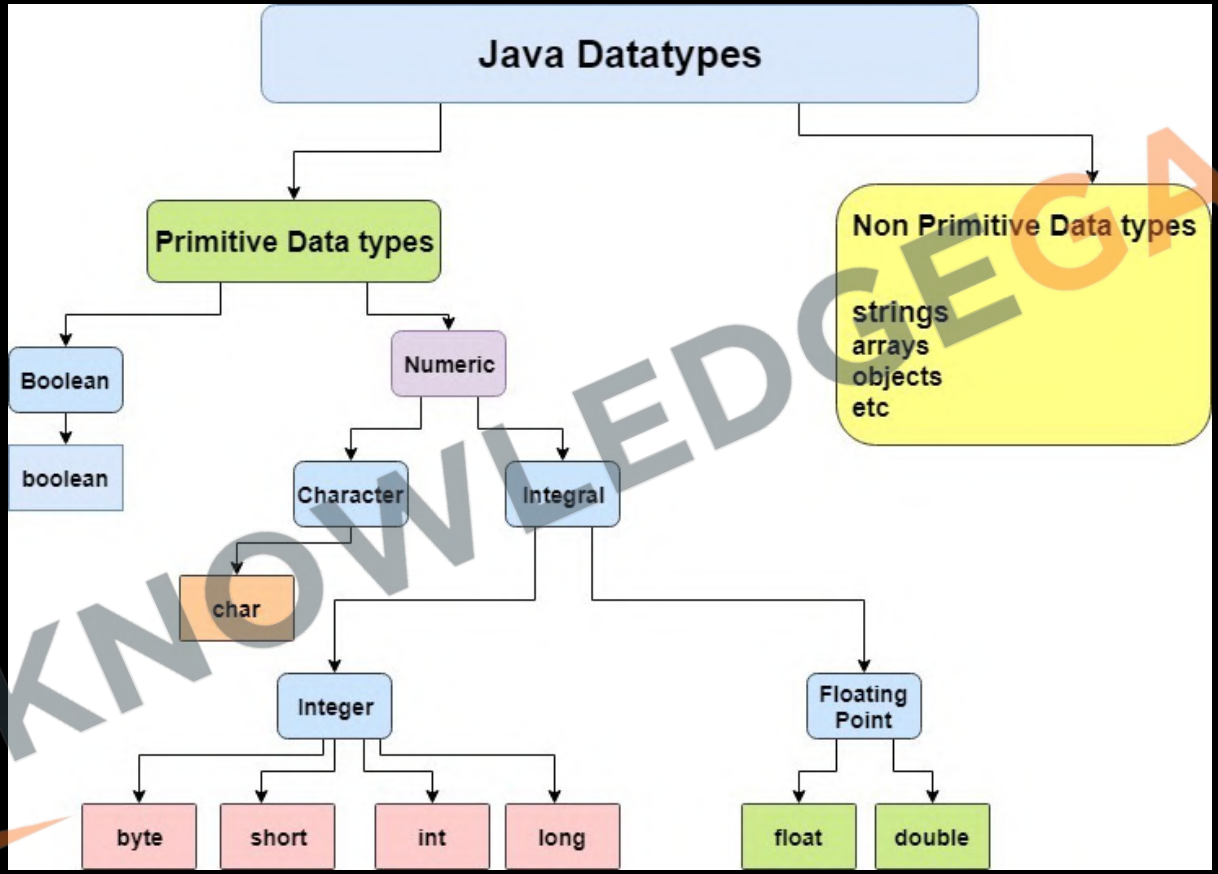
3.1. Variable Declaration



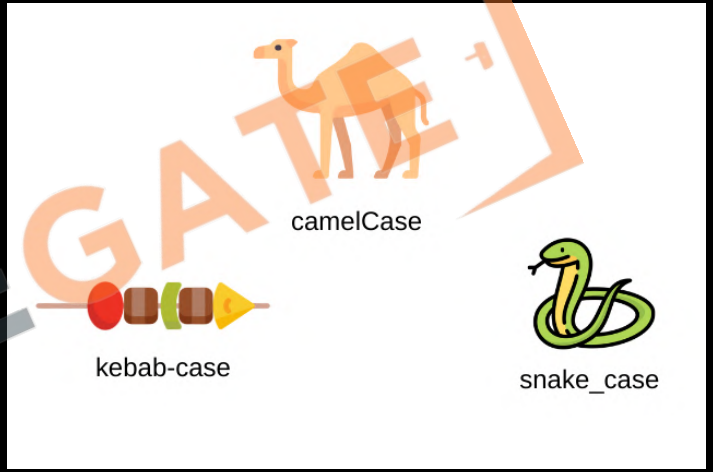
3.2 Data Types

	Size	Default Value	Type of Value Stored
byte	1 byte	0	Integral
short	2 byte	0	Integral
int	4 byte	0	Integral
long	8 byte	0L	Integral
char	2 byte	'\u0000'	Character
float	4 byte	0.0f	Decimal
double	8 byte	0.0d	Decimal
boolean	1 bit (till JDK 1.3 it uses 1 byte)	false	True or False

3.2 Data Types



3.3. Naming Conventions



camelCase

- Start with a lowercase letter. Capitalize the first letter of each subsequent word.
- Example: myVariableName

snake_case

- Start with an lowercase letter. Separate words with underscore
- Example: my_variable_name

Kebab-case

- All lowercase letters. Separate words with hyphens. Example: my-variable-name

Keep a Good and Short Name

- Choose names that are descriptive but not too long. It should make it easy to understand the variable's purpose.
- Example: age, firstName, isMarried

3.3. Java Identifier Rules

1. The only allowed characters for identifiers are all alphanumeric characters([A-Z],[a-z],[0-9]), '$' (dollar sign) and '_' (underscore).
2. Can't use keywords or reserved words
3. Identifiers should not start with digits([0-9]).
4. Java identifiers are case-sensitive.
5. There is no limit on the length of the identifier but it is advisable to use an optimum length of 4 – 15 letters only.

1)_$_ (valid)
2)Ca$h (valid)
3)Java2share (valid)
4)all@hands (invalid)
5)123abc (invalid)
6)Total# (invalid)
7)Int (valid)
8)Integer (valid)
9)int (invalid)
10) tot123

3.4 Literals

Integer literals -> 10, 5, -8 etc...

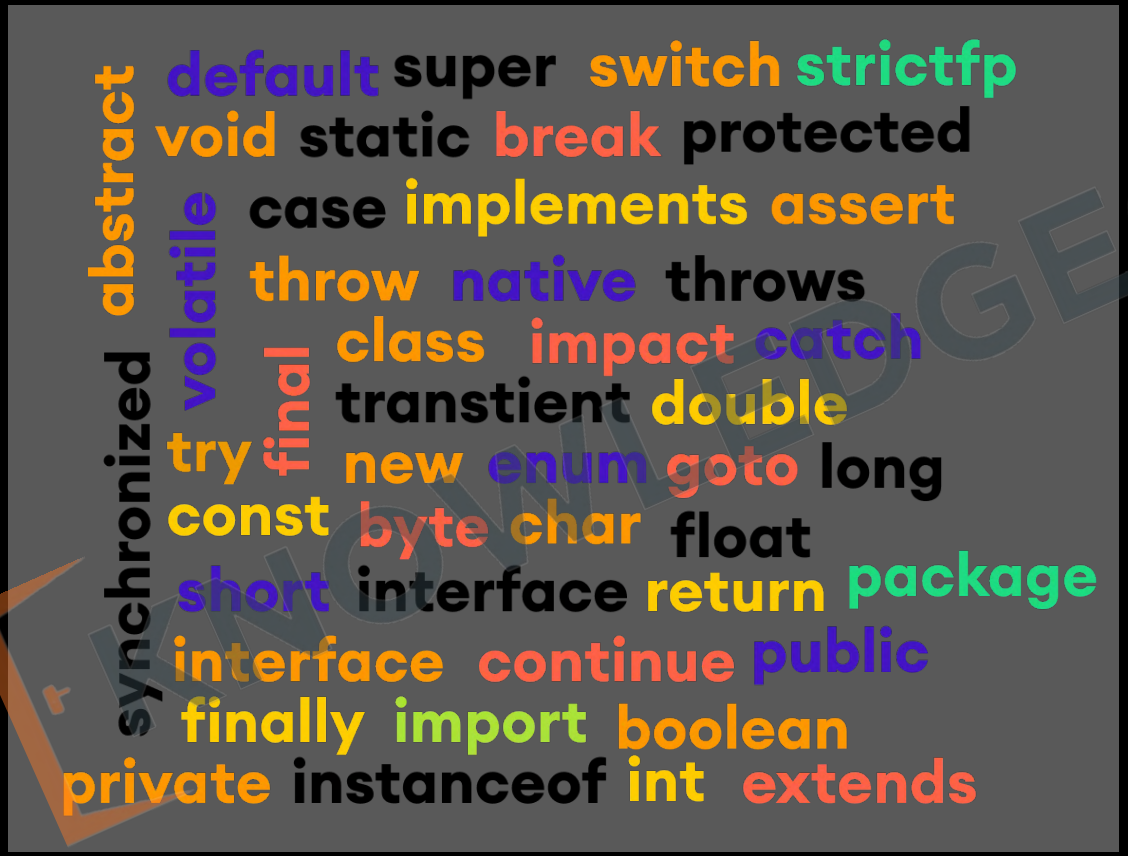
Floating-point literals -> 1.2, 0.25, -1.999, etc...

Boolean literals -> true, false

Character literals -> ‘a’, ‘A’, ‘N’, ‘q’, etc...

String literals -> “hi”, “hello”, “What’s up?”

3.5 Keywords



3.6 Escape Sequences

Escape Sequence	Description
\t	Insert a tab in the text at this point.
\b	Insert a backspace in the text at this point.
\n	Insert a newline in the text at this point.
\'	Insert a single quote character in the text at this point.
\"	Insert a double quote character in the text at this point.
\\	Insert a backslash character in the text at this point.

Task:

4. Show the following patterns using single print statement:

3.7 User Input

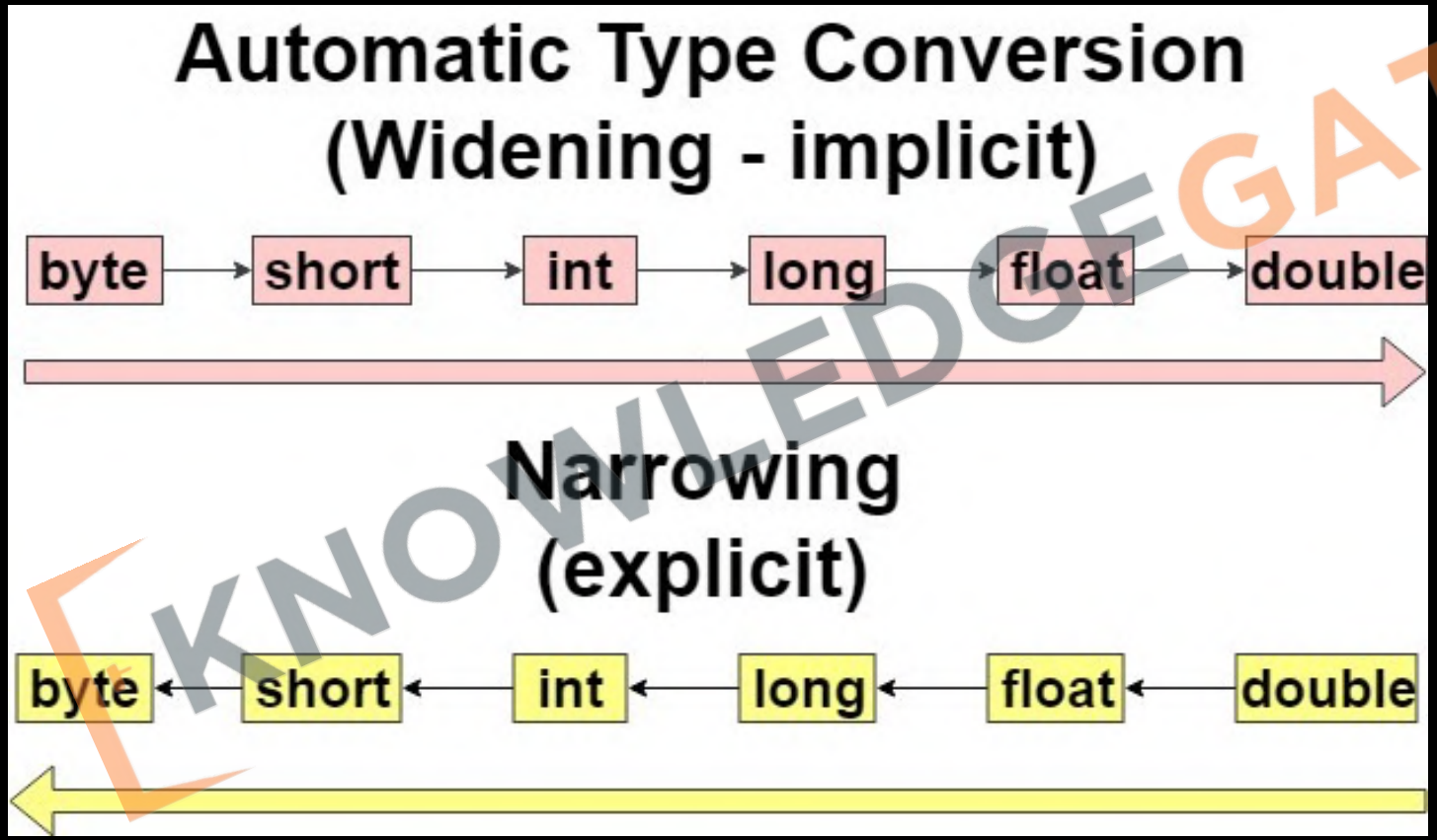
```
import java.util.Scanner;

public class Main {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter your name:");
        String name = scanner.nextLine();
        System.out.println("Welcome " + name);
    }
}
```

NAME
nextInt();
nextDouble();
nextFloat();
nextLong();
nextShort();
next();
nextLine();

5.Create a program to input name of the person and respond with ”Welcome NAME to KG Coding”

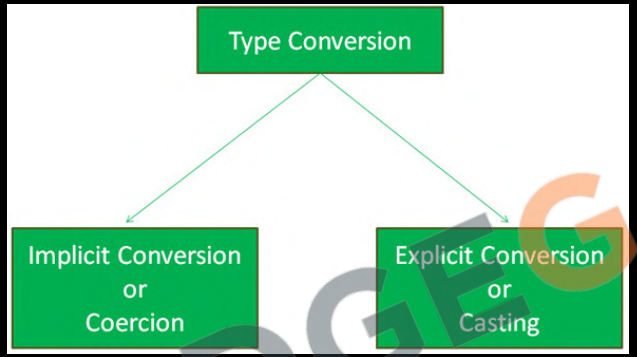
6.Create a program to add two numbers.

3.8 Type Conversion and Casting



3.8 Type Conversion and Casting

```java
// implicit
long big = 45;
float dec = 3;
double d = 3.4f;
```




```java
// explicit
float eDec = (float) 3.4;
long eBig = (long) 3.4;
int eInt = (int) 3.4;
```

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Practice Exercise

Data Types, Variables & Input

Answer in True/False:

1. In Java, a variable's name can start with a number.
2. char in Java can store a single character.
3. Class names in Java typically start with a lowercase letter.
4. 100L is a valid long literal in Java.
5. \d is an escape sequence in Java for a digit character.
6. Scanner class is used for reading console input.
7. In Java, an int can be automatically converted to a byte.
8. Java variable names are case-sensitive.
9. Scanner class can be used to read both primitive data types and strings.
10. Explicit casting is required to convert a double to an int.

Practice Exercise

Data Types, Variables & Input

Answer in True/False:

1. In Java, a variable's name can start with a number. — False
2. char in Java can store a single character. — True
3. Class names in Java typically start with a lowercase letter. — False
4. 100L is a valid long literal in Java. — True
5. \d is an escape sequence in Java for a digit character. — False
6. Scanner class is used for reading console input. — True
7. In Java, an int can be automatically converted to a byte. — False
8. Java variable names are case-sensitive. — True
9. Scanner class can be used to read both primitive data types and strings. — True
10. Explicit casting is required to convert a double to an int. — True

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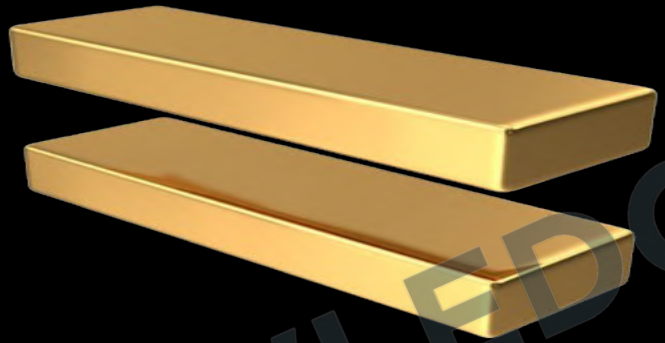
4. Operators, If-else & Number System

1. Assignment Operator
2. Arithmetic Operators
3. Order of Operation
4. Shorthand Operators
5. Unary Operators
6. If-else
7. Relational Operators
8. Logical Operators
9. Operator Precedence
10. Intro to Number System
11. Intro to Bitwise Operators

4.1 Assignment Operator



Assigns the right-hand operand's value to the left-hand operand.

Example: int a = 5;.

CHALLENGE

7. Create a program to swap two numbers.

4.2 Arithmetic Operators

Operators	Meaning	Example	Result
+	Addition	4+2	6
-	Subtraction	4-2	2
*	Multiplication	4*2	8
/	Division	4/2	2
%	Modulus operator to get remainder in integer division	5%2	1

4.3 Order of Operation

B	O	D	M	A	S
Bracket	Order	Divide	Multiply	Add	Subtract
( )	$\sqrt{x}$ x^2	÷ or x	+ or -		
Parentheses	Exponents	Multiply	Divide	Add	Subtract
P	E	M	D	A	S

4.4 Shorthand Operators

Operator symbol	Name of the operator	Example	Equivalent construct
+=	Addition assignment	x += 4;	x = x + 4;
-=	Subtraction assignment	x -= 4;	x = x - 4;
*=	Multiplication assignment	x *= 4;	x = x * 4;
/=	Division assignment	x /= 4;	x = x / 4;
%=	Remainder assignment	x %= 4;	x = x % 4;

4.5 Unary Operators

Operator	Description	Example
-	Converts a positive value to a negative	x = -y
Pre Increment	Increment the value by 1 and then use it in our statement	x = ++y
Pre Decrement	Decrement the value by 1 and then use it in our statement	x = --y
Post Increment	Use current value in the statement and then increment it by 1	x = y++
Post Decrement	Use current value in the statement and then decrement it by 1	x = y--

CHALLENGE

8. Create a program that takes two numbers and shows result of all arithmetic operators (+,-,*,/,%).
9. Create a program to calculate product of two floating points numbers.
10. Create a program to calculate Perimeter of a rectangle.
    Perimeter of rectangle ABCD = A+B+C+D
11. Create a program to calculate the Area of a Triangle.
    Area of triangle = ½*B*H
12. Create a program to calculate simple interest.
    Simple Interest = (P x T x R)/100
13. Create a program to calculate Compound interest.
    Compound Interest = P(1 + R/100)t
14. Create a program to convert Fahrenheit to Celsius
    °C = (°F - 32) × 5/9

4.6 if-else

1. Syntax: Uses if () {} to check a condition.
2. What is if: Executes block if condition is true, skips if false.
3. What is else: Executes a block when the if condition is false.
4. Curly Braces can be omitted for single statements, but not recommended.
5. If-else Ladder: Multiple if and else if blocks; only one executes.
6. Use Variables: Can store conditions in variables for use in if statements.

4.7 Relational Operators

<, >, <=, >=, ==, !=

Equality

- == Checks value equality.

Inequality

- != Checks value inequality.

Relational

- > Greater than.
- < Less than.
- >= Greater than or equal to.
- <= Less than or equal to.

Order of Relational operators is less than arithmetic operators

4.8 Logical Operators


AND


Or

NOT

1. Types: && (AND), || (OR), ! (NOT)
2. AND (&&): All conditions must be true for the result to be true.
3. OR (||): Only one condition must be true for the result to be true.
4. NOT (!): Inverts the Boolean value of a condition.
5. Lower Priority than Math and Comparison operators

CHALLENGE

15.Create a program that determines if a number is positive, negative, or zero.

16.Create a program that determines if a number is odd or even.

17. Create a program that determines the greatest of the three numbers.

18.Create a program that determines if a given year is a leap year (considering conditions like divisible by 4 but not 100, unless also divisible by 400).

19.Create a program that calculates grades based on marks

A -> above 90% B -> above 75%

C -> above 60% D -> above 30%

F -> below 30%

20.Create a program that categorize a person into different age groups

Child -> below 13 Teen -> below 20

Adult -> below 60 Senior-> above 60

4.9 Operator Precedence

Operator Type	Category	Precedence	Associativity
Unary	postfix	a++, a--	Right to left
	prefix	++a, --a, +a, -a, ~, !	Right to left
Arithmetic	Multiplication	*, /, %	Left to Right
	Addition	+, -	Left to Right
Shift	Shift	<<, >>, >>>	Left to Right
Relational	Comparison	<, >, <=, >=, instanceOf	Left to Right
	equality	==, !=	Left to Right
Bitwise	Bitwise AND	&	Left to Right
	Bitwise exclusive OR	^	Left to Right
	Bitwise inclusive OR	|	Left to Right
Logical	Logical AND	&&	Left to Right
	Logical OR	||	Left to Right
Ternary	Ternary	? :	Right to Left
Assignment	assignment	=, +=, -=, *=, /=, %=, &=, ^=, |=, <<=, >>=, >>>=	Right to Left

Operator Precedence: Determines the evaluation order of operators in an expression based on their priority levels.

Associativity: Defines the order of operation for operators with the same precedence, usually left-to-right or right-to-left.

4.10 Intro to Number System

Number System	Base or Radix	Digits or symbols
Binary	2	0,1
Octal	8	0,1,2,3,4,5,6,7
Hexadecimal	16	0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F

Number System	Base or Radix	Digits or symbols
Unary	1	0/1
Decimal	10	0,1,2,3,4,5,6,7,8,9

4.10 Intro to Number System

Decimal Number System

- Decimal Number System is a base-10 system that has ten digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.
- The decimal number system is said to be of base, or radix, 10 because it uses 10 digits and the coefficients are multiplied by powers of 10.
- This is the base that we often use in our day to day life.
- Example: $(7,392)_{10}$, where 7,392 is a shorthand notation for what should be written as

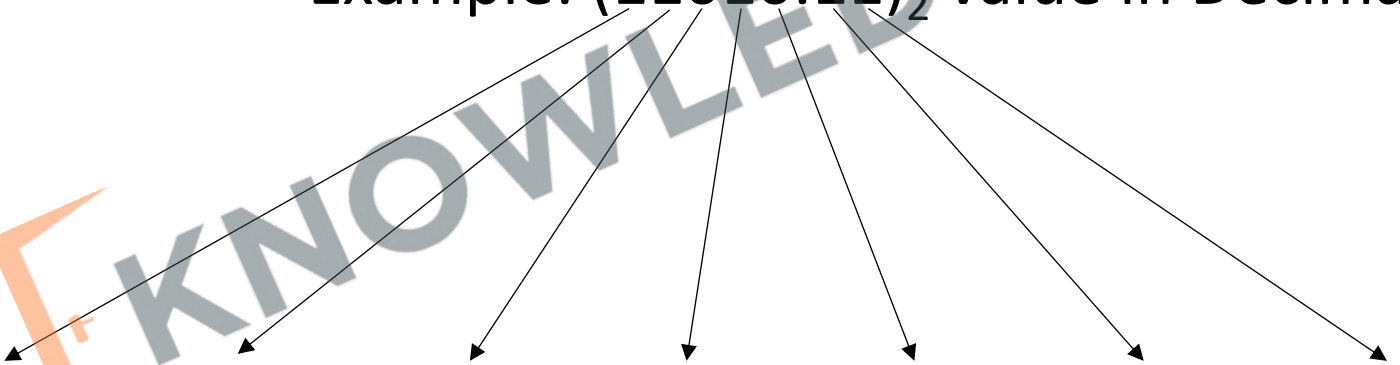
$$7 * 10^3 + 3 * 10^2 + 9 * 10^1 + 2 * 10^0$$

4.10 Intro to Number System

Binary Number System

- The coefficients of the binary number system have only two possible values: 0 and 1.
- Each coefficient a_j is multiplied by a power of the radix, e.g., 2^j, and the results are added to obtain the decimal equivalent of the number.

Example: $(11010.11)_2$ value in Decimal?



$$1 * 2^4 + 1 * 2^3 + 0 * 2^2 + 1 * 2^1 + 0 * 2^0 + 1 * 2^{-1} + 1 * 2^{-2} = 26.75$$

4.10 Intro to Number System

Decimal	Binary
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

4.11 Intro to Bitwise Operators

1.AND Operator (&): Performs on two integers. Each bit of the output is 1 if the corresponding bits of both operands are 1, otherwise 0.
2.OR Operator (|): Performs on two integers. Each bit of the output is 0 if the corresponding bits of both operands are 0, otherwise 1.
3.XOR Operator (^): Performs on two integers. Each bit of the output is 1 if the corresponding bits of the operands are different.
4.NOT Operator (~): Performs a bitwise complement. It inverts the bits of its operand (0 becomes 1, and 1 becomes 0).
5.Left Shift Operator (<<): Shifts the left operand's bits to the left by the number of positions specified by the right operand, filling the new rightmost bits with zeros.
6.Right Shift Operator (>>): Shifts the left operand's bits to the right. If the left operand is positive, zeros are filled into the new leftmost bits; if negative, ones are filled in.

CHALLENGE

21. Create a program that shows bitwise AND of two numbers.
22. Create a program that shows bitwise OR of two numbers.
23. Create a program that shows bitwise XOR of two numbers.
24. Create a program that shows bitwise compliment of a number.
25. Create a program that shows use of left shift operator.
26. Create a program that shows use of right shift operator.
27. Write a program to check if a given number is even or odd using bitwise operators.

Revision

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Practice Exercise

Operators, If-else & Number System

Answer in True/False:

1.In Java, && and || operators perform short-circuit evaluation.
2.In an if-else statement, the else block executes only when the if condition is false.
3.Java allows an if statement without the else part.
4.The ^ operator in Java is used for exponentiation.
5.Unary minus operator can be used to negate the value of a variable in Java.
6.a += b is equivalent to a = a + b in Java.
7.In Java, the binary number system uses base 10.
8.The number 1010 in binary is equivalent to 10 in decimal.
9.& and | are logical operators in Java.
10.In Java, a >> 2 shifts the binary bits of a to the left by 2 positions.

Practice Exercise

Operators, If-else & Number System

Answer in True/False:

1. In Java, && and || operators perform short-circuit evaluation. — True
2. In an if-else statement, the else block executes only when the if condition is false. — True
3. Java allows an if statement without the else part. — True
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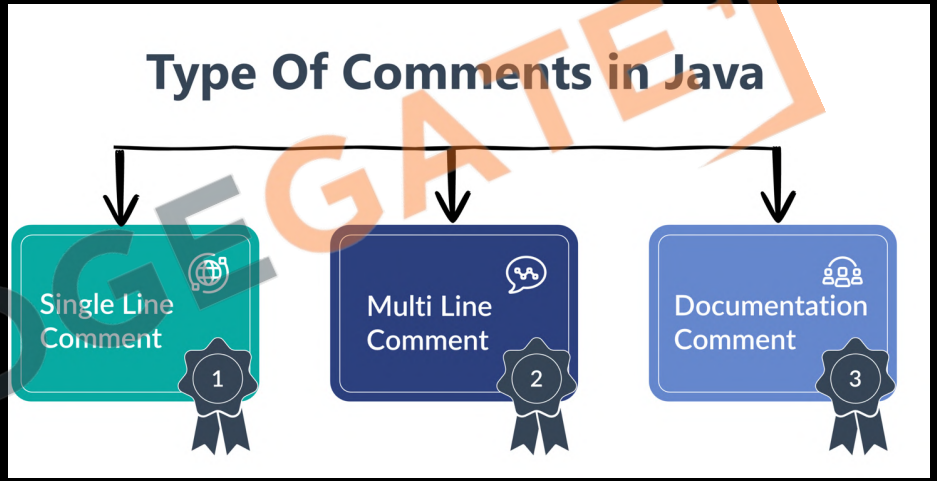
5 While Loop, Methods & Arrays

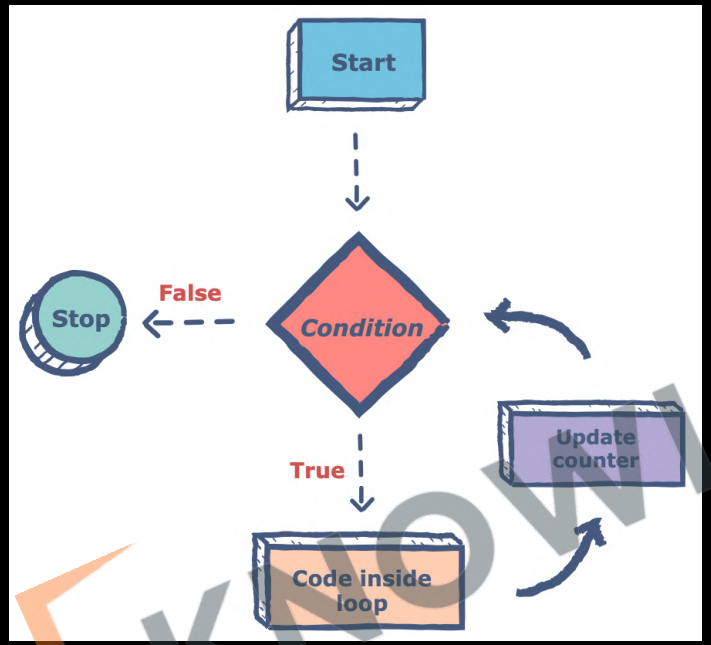
1. Comments
2. While Loop
3. Methods
4. Return statement
5. Arguments
6. Arrays
7. 2D Arrays

5.1 Java Comments

1. Used to add notes in Java code
2. Not displayed on the web page
3. Helpful for code organization
4. Syntax:
    1. Single Line: //
    2. Multi Line: /* */
    3. Java Docs: /** */

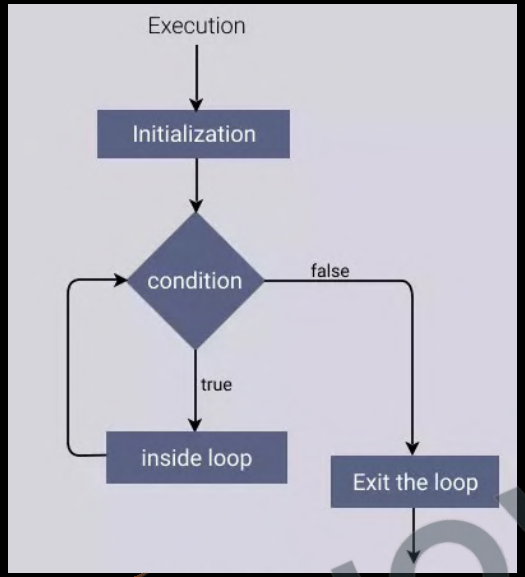


5.2 What is a Loop?



1. Code that runs multiple times based on a condition.
2. Repeated execution of code.
3. Loops automate repetitive tasks.
4. Types of Loops: while, for, while, do-while.
5. Iterations: Number of times the loop runs.

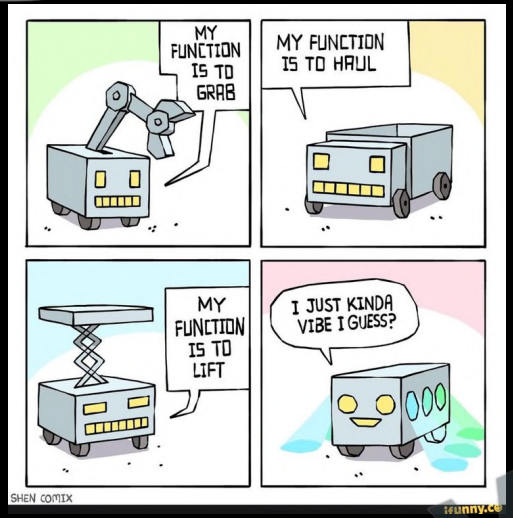
5.2 While Loop




```
while (condition) {
  // Body of the loop
}
```

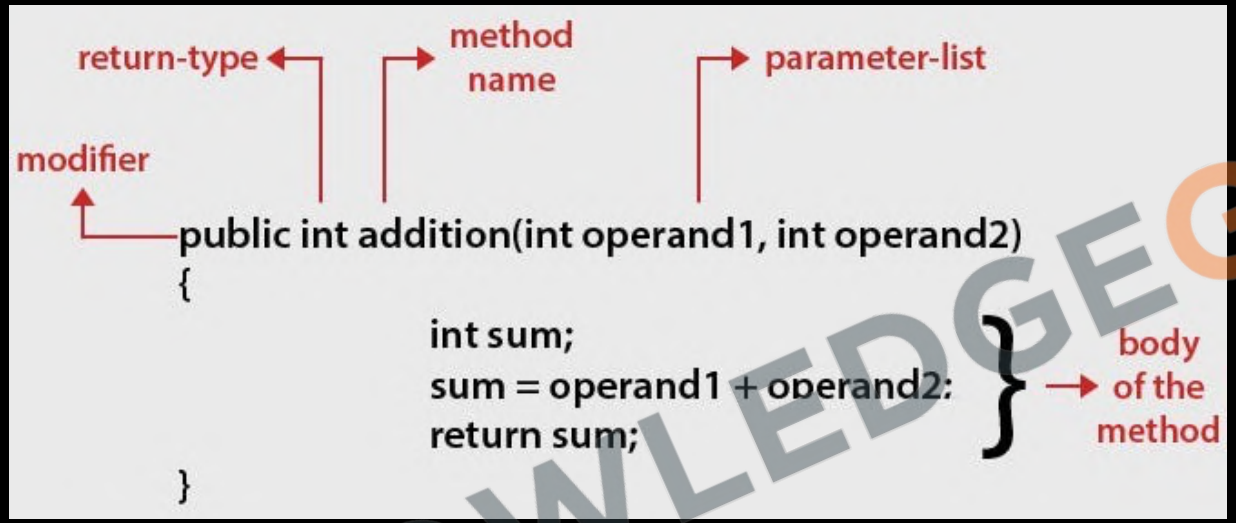

1. Iterations: Number of times the loop runs.
2. Used for non-standard conditions.
3. Repeating a block of code while a condition is true.
4. Remember: Always include an update to avoid infinite loops.

5.3 What are Functions / Methods?



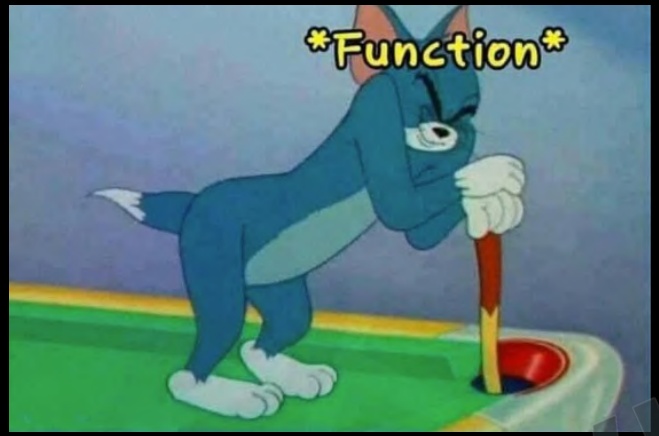
1. Definition: Blocks of reusable code.
2. DRY Principle: "Don't Repeat Yourself" it Encourages code reusability.
3. Usage: Organizes code and performs specific tasks.
4. Naming Rules: Same as variable names: camelCase
5. Example: ”Beta Gas band kar de"

5.3 Method Syntax



1. Follows same rules as variable names.
2. Use () to contain parameters.
3. Invoke by using the function name followed by ().
4. Fundamental for code organization and reusability.

5.4 Return statement



1. Sends a value back from a function.
2. Example: "Ek glass paani laao"
3. What Can Be Returned: Value, variable, calculation, etc.
4. Return ends the function immediately.
5. Function calls make code jump around.
6. Prefer returning values over using global variables.

5.5 Arguments vs Parameters

Parameter

Function

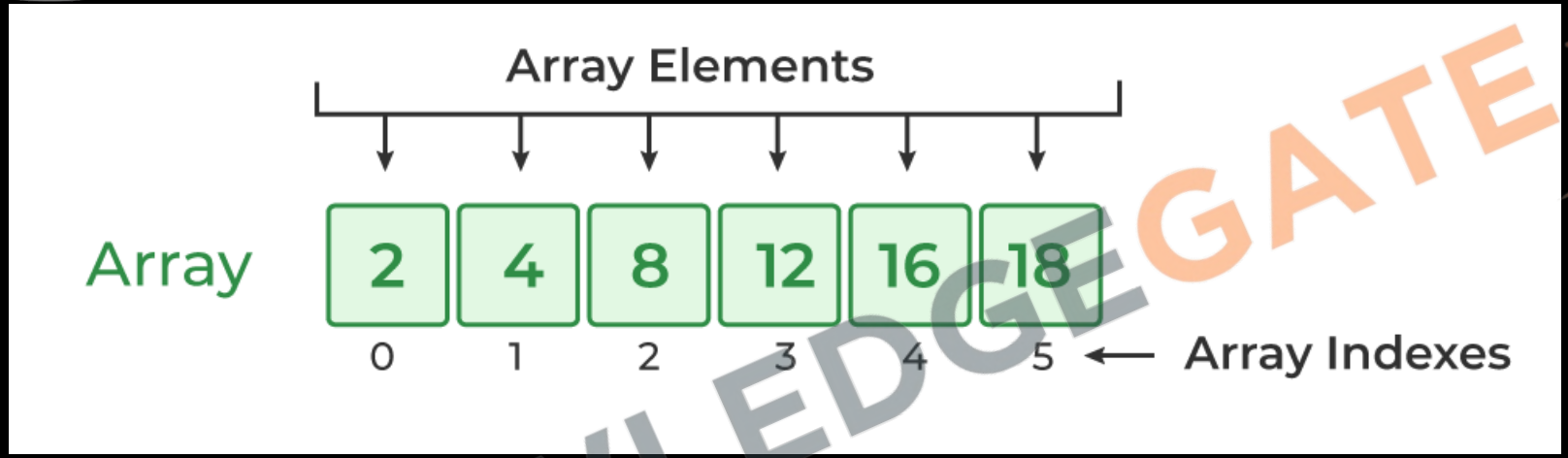
Return

1. Input values that a function takes.
2. Parameters put value into function, while return gets value out.
3. Example: "Ek packet dahi laao"
4. Naming Convention: Same as variable names.
5. Parameter vs Argument
6. Examples: System.out.print, Scanner.nextInt(), are functions we have already used
7. Multiple Parameters: Functions can take more than one.
8. Default Value: Can set a default value for a parameter.

CHALLENGE

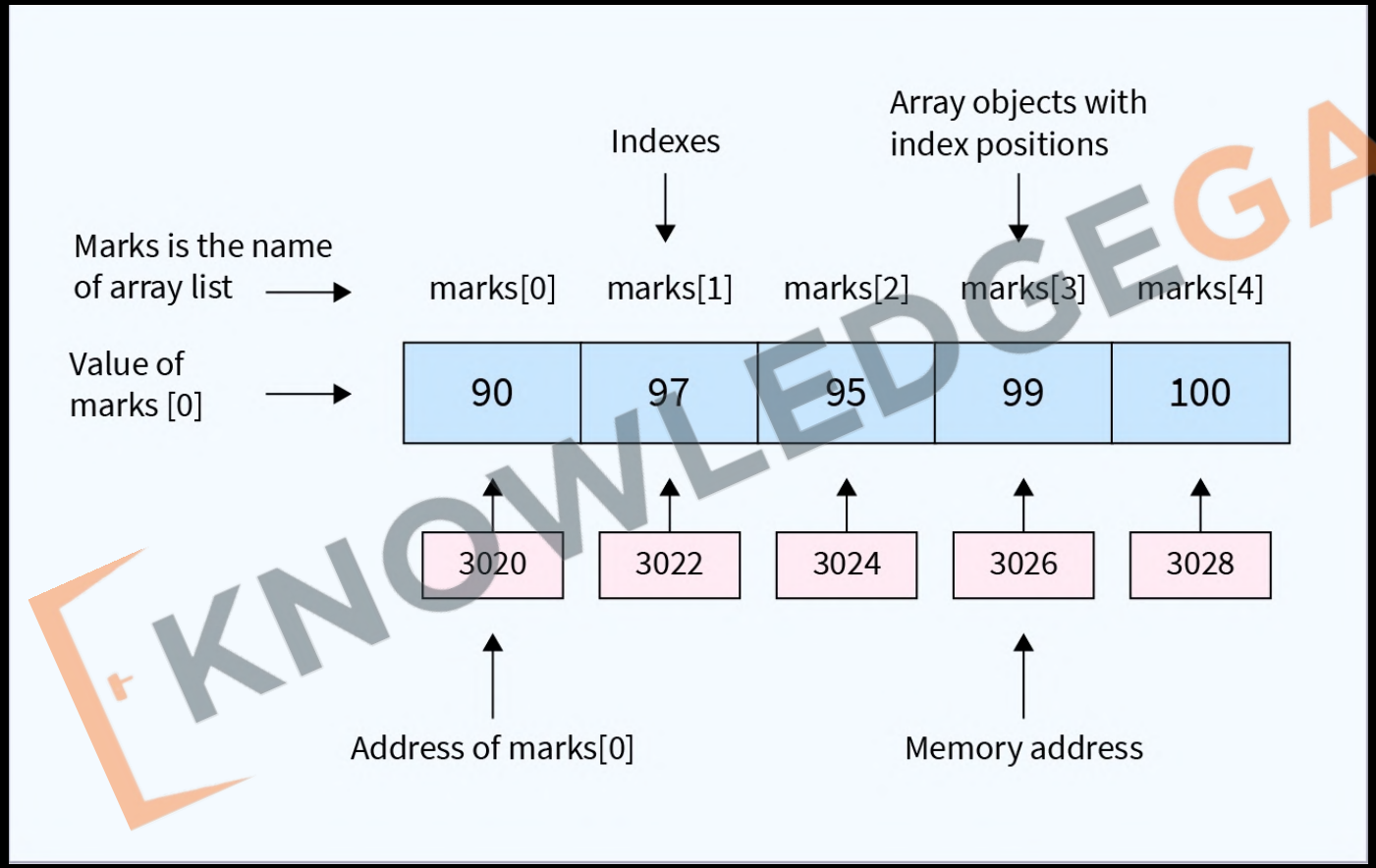
28. Develop a program that prints the multiplication table for a given number.
29. Create a program to sum all odd numbers from 1 to a specified number N.
30. Write a function that calculates the factorial of a given number.
31. Create a program that computes the sum of the digits of an integer.
32. Create a program to find the Least Common Multiple (LCM) of two numbers.
33. Create a program to find the Greatest Common Divisor (GCD) of two integers.
34. Create a program to check whether a given number is prime.
35. Create a program to reverse the digits of a number.
36. Create a program to print the Fibonacci series up to a certain number.
37. Create a program to check if a number is an Armstrong number.
38. Create a program to verify if a number is a palindrome.
39. Create a program that print patterns:

5.6 What is an Array?

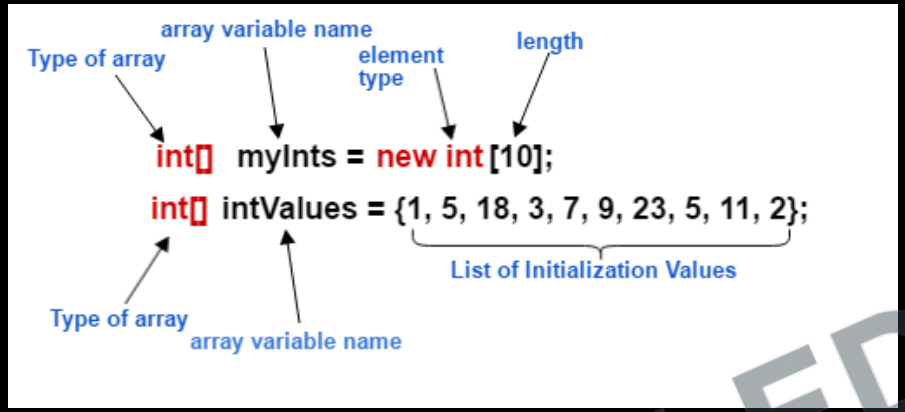


1. An Array is just a list of values.
2. Index: Starts with 0.
3. Arrays are used for storing multiple values in a single variable.

5.6 Array Memory



5.6 Array Syntax



1. Use {} to create a new array, {} brackets enclose list of values
2. Arrays can be saved to a variable.
3. Accessing Values: Use [] with index.
4. Syntax Rules:
   - Brackets start and end the array.
   - Values separated by commas.
   - Can span multiple lines.

5.6 Array Length

Array length = Array's Last Index + 1

Array's last index = 7

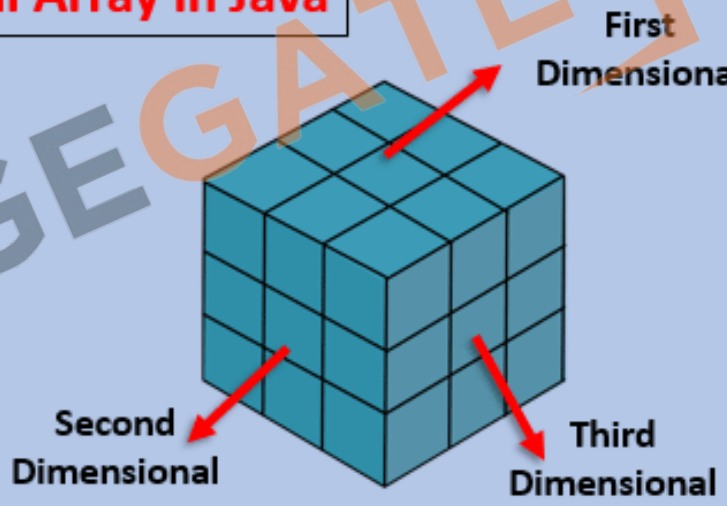
Arraylength = 7 + 1 = 8

5.7 2D Arrays

Types of Multidimensional Array in Java

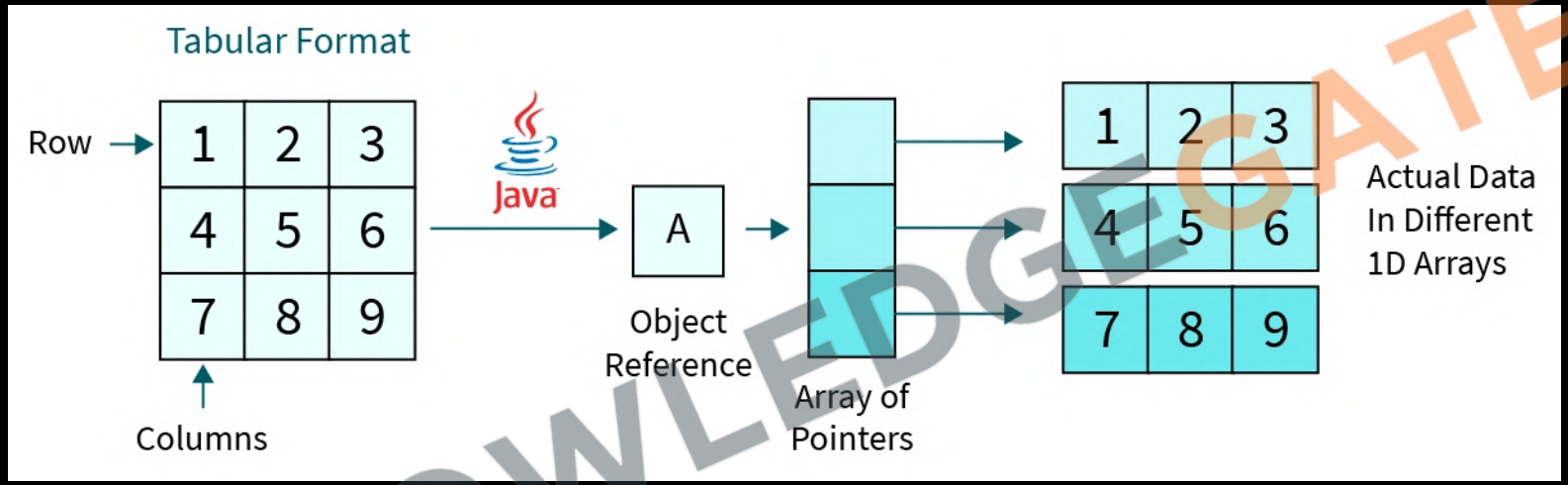
	Column 0	Column 1	Column 2
Row 0	X[0][0]	X[0][1]	X[0][2]
Row 1	X[1][0]	X[1][1]	X[1][2]
Row 2	X[2][0]	X[2][1]	X[2][2]

2D-Array



3D-Array

5.7 2D Arrays



5.7 2D Arrays

```
int[][] numArr = new int[2][3];
int[][] inArray = {{1, 2, 5}, {8, 9, 4}};

numArr[0][0] = 5;
```

CHALLENGE

40. Create a program to find the sum and average of all elements in an array.
41. Create a program to find number of occurrences of an element in an array.
42. Create a program to find the maximum and minimum element in an array.
43. Create a program to check if the given array is sorted.
44. Create a program to return a new array deleting a specific element.
45. Create a program to reverse an array.
46. Create a program to check is the array is palindrome or not.
47. Create a program to merge two sorted arrays.
48. Create a program to search an element in a 2-D array.
49. Create a program to do sum and average of all elements in a 2-D array.
50. Create a program to find the sum of two diagonal elements.

Revision

1. Comments
2. While Loop
3. Methods
4. Return statement
5. Arguments
6. Arrays
7. 2D Arrays

Practice Exercise

While Loop, Methods & Arrays

Answer in True/False:

1. A 'while' loop in Java continues to execute as long as its condition is true.
2. The body of a 'while' loop will execute at least once, regardless of the condition.
3. A 'while' loop cannot be used for iterating over an array.
4. Infinite loops are not possible with 'while' loops in Java.
5. A method in Java can return more than one value at a time.
6. It's mandatory for every Java method to have a return type.
7. The size of an array in Java can be modified after it is created.
8. Arrays in Java can contain elements of different data types.
9. An array is a reference type in Java.
10. Java arrays are zero-indexed, meaning the first element has an index of 0.

Practice Exercise

While Loop, Methods & Arrays

Answer in True/False:

1. A 'while' loop in Java continues to execute as long as its condition is true. — True
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